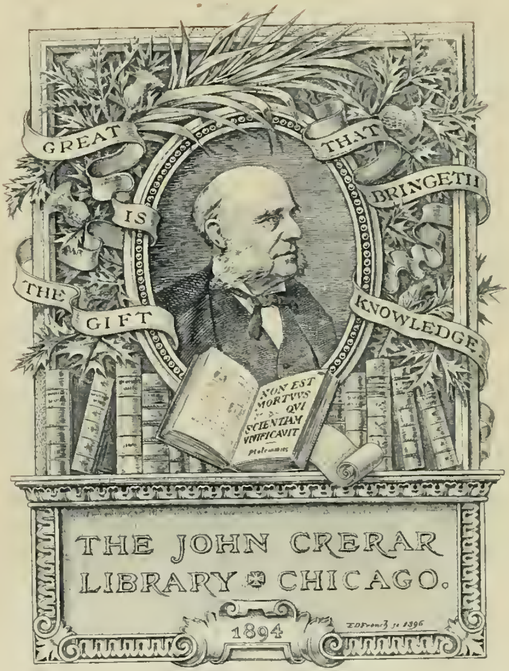
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Colorado School of Mines

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Colorado School of Mines

GOLDEN
COLORADO

Catalogue
1901-1902

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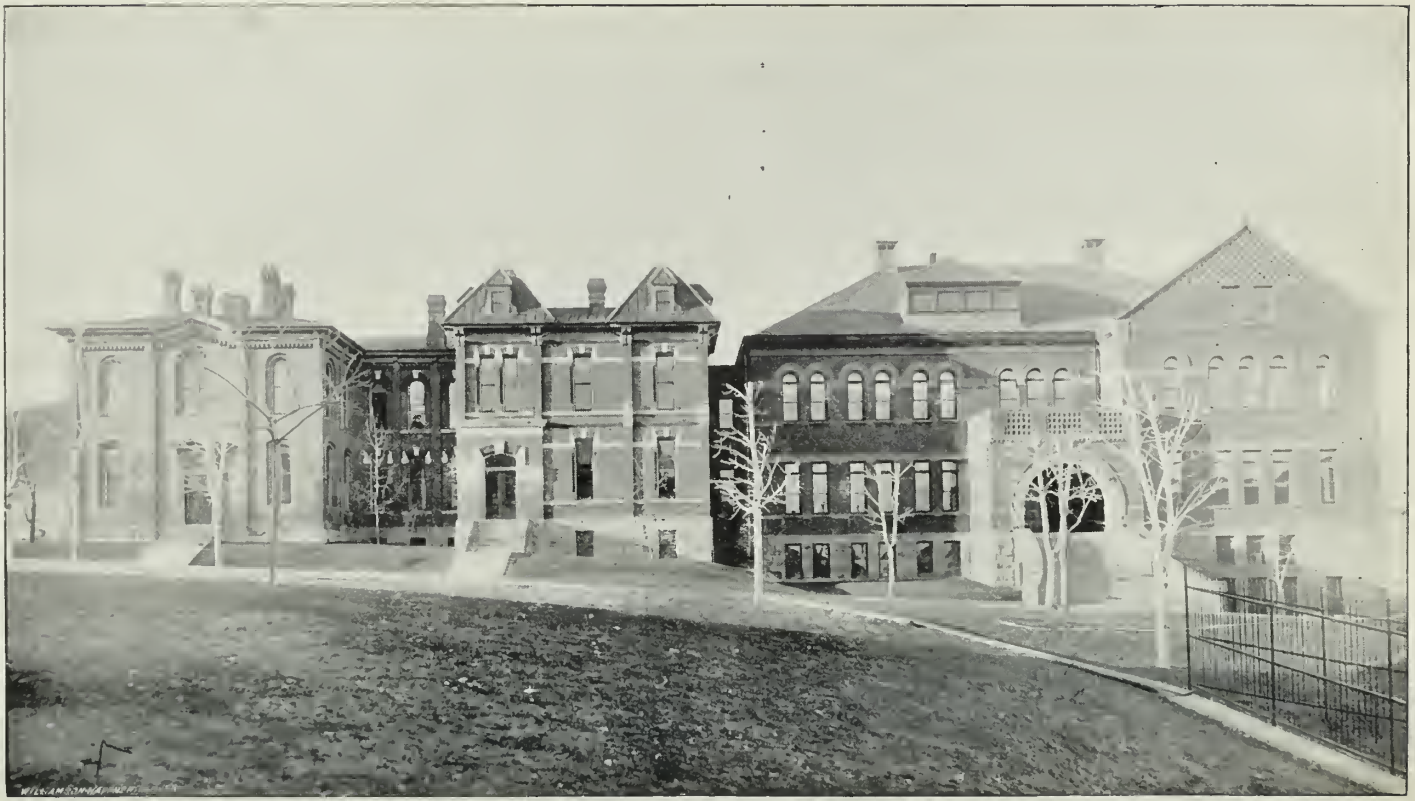

STATE SCHOOL OF MINES. EAST FRONT OF MAIN BUILDINGS.

1880. 1882. 1890

CATALOGUE

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1901-1902.

CALENDAR.

1901-1902

First Term Begins Sept. 16, 1901. Ends Feb. 12, 1902.
(Christmas Holidays Dec. 21—Jan. 5, inclusive.)
Second Term Begins Feb. 17, 1902. Ends June 18, 1902.
Commencement, June 19, 1902.

1902-1903.

EXAMINATIONS FOR ADMISSION.

June 20, 21, 1902. September 11, 12, 13, 1902.

First Term Begins Sept. 15, 1902. Ends Feb. 4, 1903.
(Christmas Holidays, Dec. 20—Jan. 4, inclusive.)
Second Term Begins Feb. 9, 1903. Ends June 10, 1903.
Commencement, June 11, 1903.

BOARD OF TRUSTEES.

James T. Smith	Denver, Arapahoe County.
Frank Bulkley	Denver, Arapahoe County.
Winfield S. Stratton	Colorado Springs, El Paso Co.
Edward L. Berthoud	Golden, Jefferson County.
Otto F. Thum	Denver, Arapahoe County.

OFFICERS OF THE BOARD.

President	Frank Bulkley.
Secretary	James T. Smith.
Treasurer	J. W. Rubey.

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A. M., LL. D. (Washington University.)
B. S., (Harvard.)
President and Professor of Chemistry.

Paul Meyer, Ph. D., (Giessen.)
Professor Emeritus of Mathematics.

Louis Clarence Hill, C. E., E. E., (University of Michigan.)
Professor of Physics and Electrical Engineering.

Horace Bushnell Patton,
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Ph. D., (Heidelberg.)
Professor of Geology and Mineralogy.

Arthur Ransley Curtis, B. S., (Case School of Applied Science.)
Professor of Machine Design and Draughting.

Charles Worthington Comstock,
E. M., C. E., (Colorado School of Mines.)
M. C. E., Ph. D., (Cornell.)
Professor of Mining Engineering.

Robert Summers Stockton, E.M., (Colorado School of Mines.)
Professor of Mathematics and Surveying.

Carlton Raymond Rose,
Ph. B., A. M., (University of Michigan.)
Professor of Metallurgy and Assaying.

William Jonathan Hazard, E. E., (Colorado School of Mines.)
Assistant Professor in Physics and Draughting.

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Professor of Analytical Chemistry. Assistant Professor in Mineralogy.

ANDREW WEISS, E. M., (Colorado School of Mines.)
Assistant Professor in Mathematics and Surveying.

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Instructor in Analytical Chemistry.

WILLIAM GEORGE HALDANE, B. S., (Case School of Applied Science.)
Instructor in Mathematics and Draughting.

WALTER MONROE HAMILTON,
A. B., A. M., (University of Michigan.)
Instructor in Mathematics.

JULIUS WOOSTER EGGLESTON,
B. S., (Amherst.)
M. A., (Harvard.)
Assistant, Department of Mineralogy.

COMMITTEE ON STANDING AND CONDITIONS.

Professors Hill, Comstock, Stockton.

COMMITTEE ON ATHLETICS.

Professors Chauvenet, Patton, Stockton.

COMMITTEE ON BUILDINGS AND EQUIPMENT.

Professors Curtis, Hill, Comstock.

COMMITTEE ON LIBRARY.

Professors Comstock, Rose, Curtis.

BENJAMIN A. AMBLER,
Registrar.

MABEL C. SHRUM,
B. L. S., (University of Illinois.)
Librarian.

HERBERT H. WINN,
Curator of Apparatus.

STUDENTS, 1901-1902.

Seniors	25
Juniors	44
Sophomores	54
Freshmen	121
Total	244

SUMMARY BY STATES AND COUNTRIES.

Colorado	160
Missouri	11
Illinois	8
Iowa	7
Oregon	7
Texas	7
Ohio	6
Nebraska	5
California	5
New York	3
Wyoming	3
District of Columbia	2
Idaho	2
Kansas	2
Michigan	2
Arizona	1
British Columbia	1
Connecticut	1
Corea	1
England	1
Indiana	1
Massachusetts	1
Mexico	1
New Jersey	1
New Mexico	1
Pennsylvania	1
Utah	1
Washington	1
Wisconsin	1

Colorado, sixty-six per cent. All others, thirty-four per cent.

SENIORS.

Anderson, Neil A.	Union, Idaho.
Badger, Herbert E.	Greeley, Colorado.
Barron, Chauncey T.	El Paso, Texas.
Bergh, John Evans	Denver, Colorado.
Bucher, John William (A. B., Sacred Heart College, Colo.)	Denver, Colorado.
Butler, G. Montague	Golden, Colorado.
Charles, Lavern J.	Morrison, Colorado.
Christensen, Walter	Fremont, Nebraska.
Coghill, Will Hawes	Monmouth, Illinois.
Collbran, Arthur Harry	Seoul, Corea.
Cox, W. Ray	Golden, Colorado.
Ehrich, Walter L. (Ph. B., Yale.)	Colorado Springs, Colo.
Ellis, William Witty	Denver, Colorado.
Estes, Frank M., Jr.	St. Louis, Missouri.
Ickis, Harry M.	Creston, Iowa.
Lehmer, Frank Welton	Omaha, Nebraska.
Montrose, James Fay	Denver, Colorado.
Moss, Cleveland Osgood	Denver, Colorado.
Paul, Russell B.	Denver, Colorado.
Powers, Oliver	Ainger, Ohio.
Reno, Horace Thornton	Arvada, Colorado.
Richards, John V.	Spokane, Washington.
Rowe, Charles Elmer (B. S., C. E., University of Colorado.)	Round Rock, Texas.
Storm, Lynn W.	Denver, Colorado.
Watts, Alfred C.	Newark, New Jersey.

JUNIORS.

Adams, Charles	Denver, Colorado.
Aicher, Charles P.	Denver, Colorado.
Cox, Augustus D.	Golden, Colorado.
D'Arcy, Arthur I.	Denver, Colorado.
Devinney, George Valentine	Edgewater, Colorado.
Dunkle, Fred W.	Indianapolis, Indiana.
Emeis, Walter A.	Davenport, Iowa.
Emrich, Horace H.	Pueblo, Colorado.
Foster, George C.	Chillicothe, Ohio.
Fleming, William L.	Denver, Colorado.
Fry, Louis D.	Denver, Colorado.
Funk, Walter A.	Staten Island, New York.
Gates, Arthur O. (B. S., E. E., Purdue University, Ind.)	Toledo, Ohio.
Gilman, Chas. Edward	Palo Alto, California.
Hyder, Frederick B.	Denver, Colorado.
Izett, Glen	Denver, Colorado.
Kauffman, Milton H.	Cincinnati, Ohio.
Kilbourn, William D.	Pueblo, Colorado.
Kimball, Harlow M.	Evanston, Illinois.
King, Henry E.	Colorado Springs, Colo.
Liddell, Charles A.	Golden, Colorado.
Liddell, T. Parker	Golden, Colorado.
McDermut, Grace C. U.	Denver, Colorado.

JUNIORS—Continued.

McElvenny, Robert F.-------Denver, Colorado.
*McGregor, George H.-------Estes Park, Colorado.
(E. M., Colo. School of Mines.)
Merwin, Eugene W.----------Los Angeles, California.
Morris, Howard G.-----------Denver, Colorado.
Nagel, Frank John----------Denver, Colorado.
Nagel, Henry P., Jr.----------Denver, Colorado.
Palsgrove, Harry G.----------Denver, Colorado.
Parks, Henry Martin--------Creston, Iowa.
Parsons, Horace Fleet--------Wamego, Kansas.
Rhodes, William Barron------Denver, Colorado.
Robinson, George P.----------Denver, Colorado.
Sloan, William Arthur-------Denver, Colorado.
Snider, Harry D. -----------Kilbourn, Wis.
(B. S., Beloit College, Wis.)
Steel, J. Marshall-----------Portland, Oregon.
Taggart, George Knight------Dallas, Texas.
Thomson, Francis Andrew----Victoria, Brit. Columbia.
Ward, William Field--------Denver, Colorado.
Washburn, Howard G.-------Denver, Colorado.
Wattles, William C.----------Denver, Colorado.
Wells, Frank B.-------------Los Angeles, California.
Wolf, Harry J.--------------Golden, Colorado.

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* Post Graduate, Special Course.

SOPHOMORES.

Anderson, Axel E.	Denver, Colorado.
Andrews, James Henderson	Fort Collins, Colorado.
Bennett, Thomas Harry	London, England.
Bicknell, John Henry	Golden, Colorado.
Blair, E. Verne	Charleston, Ill.
Blood, Raymond Frank	Denver, Colorado.
Brooks, Herbert Owen	Albuquerque, New Mex.
Buell, Arthur Whitcomb	Evergreen, Colorado.
Carnahan, Thomas S.	Ogden, Utah.
Chamberlin, William Owens	Denver, Colorado.
Coffin, Roy G.	Longmont, Colorado.
Collins, Wales S.	Denver, Colorado.
Collom, Roy Edward	Denver, Colorado.
D'Arcy, Richard L.	Denver, Colorado.
Dawson, Eugene H.	Denver, Colorado.
DeSollar, Termey Cook	Denver, Colorado.
Dudley, Charles T. (B. S., Yale.)	Washington, D. C.
Fillins, Lee Linwood	Georgetown, Colorado.
Fisher, John Benvill	Detroit, Michigan.
Frambach, Charles L.	Denver, Colorado.
Franck, Albert C.	Kansas City, Missouri.
Franck, Robert Philip	Kansas City, Missouri.
Gittings, Charles	Pueblo, Colorado.
Gulick, Ray A.	Los Angeles, California.
Hallett, William Jared	Denver, Colorado.
Hill, Frank C.	Carthage, Missouri.

SOPHOMORES—Continued.

Hunt, Thacher Rodney	Denver, Colorado.
Johnson, Lafayette Garfield	Denver, Colorado.
Julihn, Carl Edward	Washington, D. C.
Lanagan, William Harry	Denver, Colorado.
Larsh, Walter Stuart	Denver, Colorado.
Lee, Wallace	Kansas City, Missouri.
Lewis, Alfred Fitch	Wichita, Kansas.
Lohman, Harry William	Brooklyn, New York.
Nare, George Henry	Golden, Colorado.
Prier, Truman Delmar	Golden, Colorado.
Rabb, Edward Morris, Jr.	Denver, Colorado.
Rath, Charles Martin	Cheyenne, Wyoming.
Reinhard, Frank J.	Columbus, Ohio.
Rice, John Turner	Omaha, Nebraska.
Sherman, Scott H.	Denver, Colorado.
Spencer, Walter Irving	Portland, Oregon.
Stebbins, Walter Albert	Pueblo, Colorado.
Tescher, Samuel	Denver, Colorado.
Thomas, John S.	Denver, Colorado.
Trumbull, Loyal W.	Blue Island, Illinois.
Vaughn, Robert M.	Clearfield, Iowa.
Wackenhut, George John	Colorado Springs, Colo.
Wallace, Howard James	Algona, Iowa.
Wells, Benjamin T.	Pueblo, Colorado.
Weems, Thomas Buck (B. S., Illinois Wesleyan.)	Denver, Colorado.
Wilson, Arden M.	Cleveland, Ohio.
Woodress, James Leslie	Trenton, Missouri.
Wright, William Henry	Denver, Colorado.

FRESHMEN.

Allen, Carl A.	La Junta, Colorado.
Austin, Arthur	El Paso, Texas.
Bailey, Elbert Wood	Denver, Colorado.
Baker, LeRoy Irving	Denver, Colorado.
Berry, Albert	Leadville, Colorado.
Brown, Osborne Eli	Golden, Colorado.
Busey, Alfred P., Jr.	Pueblo, Colorado.
Butler, Franklin	Des Moines, Iowa.
Campbell, Benjamin Lucien	Portland, Oregon.
Carstarphen, Frederick Chas.	Denver, Colorado.
Caypless, Willis S.	Denver, Colorado.
Chase, Edwin Kirke	Denver, Colorado.
Chase, William Cruger	El Paso, Texas.
Church, Edward	Chicago, Illinois.
Colburn, Clare Lorimer	Denver, Colorado.
Corey, Clarence Raymond	Ansonia, Connecticut.
Cory, John Jerome	Denver, Colorado.
Cox, Samuel Judson	Aspen, Colorado.
Cowperthwaite, Thomas	Coal Creek, Colorado.
Cuno, Albert F.	Denver, Colorado.
de Berard, Arthur M.	Fairfax, Iowa.
Dexter, Albert John	Cripple Creek, Colorado.
Duer, Charles Louis	Denver, Colorado.
Dunn, Hugh D.	Del Norte, Colorado.

FRESHMEN—Continued.

Duthie, John Milne---------El Paso, Texas.
Eagleton, Fred -------------Denver, Colorado.
Eames, Luther Barnard------Pueblo, Colorado.
Eddy, Harold Clinton--------Middleboro, Mass.
Enos, Herbert Cory----------Denver, Colorado.
Filteau, Charles Alexander---Idaho Springs, Colorado.
Fisher, James T.------------Hastings, Nebraska.
Flint, Fred F.---------------Greeley, Colorado.
Force, James A.------------Denver, Colorado.
Ford, Homer Davis----------Denver, Colorado.
Ford, Thomas Edward-------Denver, Colorado.
Frank, Edwin Lewis---------Canon City, Colorado.
Frost, Dwight Livesey-------Kansas City, Missouri.
Fulwider, Harold -----------Denver, Colorado.
Gardner, John Ira-----------Denver, Colorado.
Gardiner, William Alexander-San Fernando, California.
Gerity, Thomas C.-----------Elmira, New York.
Gilbert, William J.----------Denver, Colorado.
Gleim, Edgar Miller---------Portland, Oregon.
Goodale, Frank Augustus-----Trinidad, Colorado.
Green, Willis----------------Craig, Colorado.
Hallett, Robert L.-----------Denver, Colorado.
Hensley, James H., Jr.-------Denver, Colorado.
Hewitt, Arthur F.-----------Denver, Colorado.

FRESHMEN—Continued

Hodge, Samuel William------Denver, Colorado.
Hornbein, Julius------------Denver, Colorado.
Hosea, Ralph Gay-----------Denver, Colorado.
Hunt, Lamar H.------------Denver, Colorado.
Hurlburt, Carroll -----------Portland, Oregon.
Hyder, Charles A.-----------Denver, Colorado.
James, Evan---------------Florence, Colorado.
Johnston, William Edward ---Denver, Colorado.
Kelly, John F.--------------Ironwood, Michigan.
Koerner, Albert John--------St. Louis, Missouri.
Kroh, Herbert A.-----------Edith, Colorado.
Larison, Eldon Lee----------Golden, Colorado.
Lee, Robert Paul------------Denver, Colorado.
Lennox, Luther Willis-------Colorado Springs, Colo.
Lewis, Charles A.-----------Denver, Colorado.
Libby, James L.------------Cheyenne, Wyoming.
Lonergan, Philip J., Jr.------Colorado Springs, Colo.
Longshore, Rudolph P.-------West Chester, Penn.
Lyneman, Emanuel John-----Denver, Colorado.
Mace, Clement Harold-------Denver, Colorado.
Marrs, William Middleton----Denver, Colorado.
McCart, Robert, Jr.----------Fort Worth, Texas.
Meeker, Ralph Inman--------Pueblo, Colorado.
Metcalf, Bradley Barlow------Denver, Colorado.

FRESHMEN—Continued.

Middlekamp, Leroy Louis-----Pueblo, Colorado.
Montgomery, Dan Tetterington Reynolds, Illinois.
More, J. Taylor------------Denver, Colorado.
Mosley, Earl Lewis----------Denver, Colorado.
Mulford, Loven Dallas-------Harris, Colorado.
Muther, Albert William------Denver, Colorado.
Neville, John Baptist, Jr.-----Cripple Creek, Colorado.
O'Byrne, Joseph F.----------Cripple Creek, Colorado.
Orr, Owen Cargill-----------St. Joseph, Missouri.
Parks, George -------------Denver, Colorado.
Pfeiffer, Guy---------------O'Fallon, Illinois.
Pilger, Newton W.----------Loup City, Nebraska.
Pollock, Ralph C.-----------Greeley, Colorado.
Pope, Worden---------------Denver, Colorado.
Pressler, Louis Philip--------Velerdena, Mexico.
Price, Evan Edmund--------Chandler, Colorado.
Price, John M.--------------Chandler, Colorado.
Prior, Arthur --------------Black Hawk, Colorado.
Putnam, George B.----------Denver, Colorado.
Reeve, Tracy---------------Denver, Colorado.
Rice, George B.-------------Denver, Colorado.
Richards, Edwin Ruthen-----Montrose, Colorado.
Ryan, Will E.--------------Denver, Colorado.
Schloesser, Alexander R.-----Chicago, Illinois.

FRESHMEN—Continued.

Scott, Glenn	Saratoga, Wyoming.
Sill, Rush Tabor	Colorado Springs, Colo.
Simpson, Maurice E.	Kansas City, Missouri.
Skinner, William Crompton	Denver, Colorado.
Smith, Eric Morris	Montrose, Colorado.
Smith, Reuben W.	Golden, Colorado.
Smith, Weston Martin	Lakewood, Colorado.
Spangler, Howard	Denver, Colorado.
Spicer, Carroll Atchison	Colorado Springs, Colo.
Stephenson, Tiffany	Fort Morgan, Colorado.
Stevenson, Leon Clark	Alamo, Oregon.
Stewart, Edward M.	Denver, Colorado.
Stillman, Charles C.	Monte Vista, Colorado.
Stoeckley, Ernest F.	Canon City, Colorado.
Tate, John Humphreys	Kansas City, Missouri.
Taylor, Clyde S.	Denver, Colorado.
Terrill, Arthur Clark	Colorado Springs, Colo.
Thomson, Arthur Theodore	Pueblo, Colorado.
Von Egidy, Albert A.	Monte Vista, Colorado.
Wallrich, William J.	Denver, Colorado.
Watt, Horace Lee	Hailey, Idaho.
Wells, Frank O.	Prescott, Arizona.
Wood, Chapp E.	Aspen, Colorado.
Young, Siegfried Astor	Astoria, Oregon.
Zulch, Herman C.	Denver, Colorado.

HISTORY AND ORGANIZATION.

The School of Mines of the State of Colorado was established by Act of the Territorial Legislative Assembly, approved February 9th, 1874.

Its first location was a mile south of the City of Golden, where it occupied rented property. It was seen that a better site and a building were conditions without which it could not survive.

The original appropriation of ten thousand dollars was the only one which the institution received in the first nineteen years of its existence. The building thus provided for was erected upon lots given by citizens of Golden, in 1880.

It was soon perceived that the school would receive support in the way of students far in excess of the capacity of the building erected from such an appropriation. From this time until 1894, all additions were made from current income, which for the greater part of the time was upon the basis of one-fifth of one mill of the tax valuation of the state.

No land having been granted by the state, and no special appropriation having ever been made toward equipment of any kind, the struggle for existence has always been severe. Of the two hundred thousand dollars now represented in the buildings and equipment, one hundred and sixty-five thousand has been saved out of income, and but thirty-five thousand has been given by appropriation.

In 1882 the original building was enlarged, and in 1890 a much larger building was added. The growth of the school imposed upon its trustees the alternative of fatally hampering its efficiency on the one hand, or of meeting the demands from current income on the other.

Engineering Hall was erected in 1894, an appropriation of twenty thousand dollars having been made for it in 1893. Prior to this, the old system of special and partial courses had been abolished, and the solid progress since made may be fairly ascribed to this change.

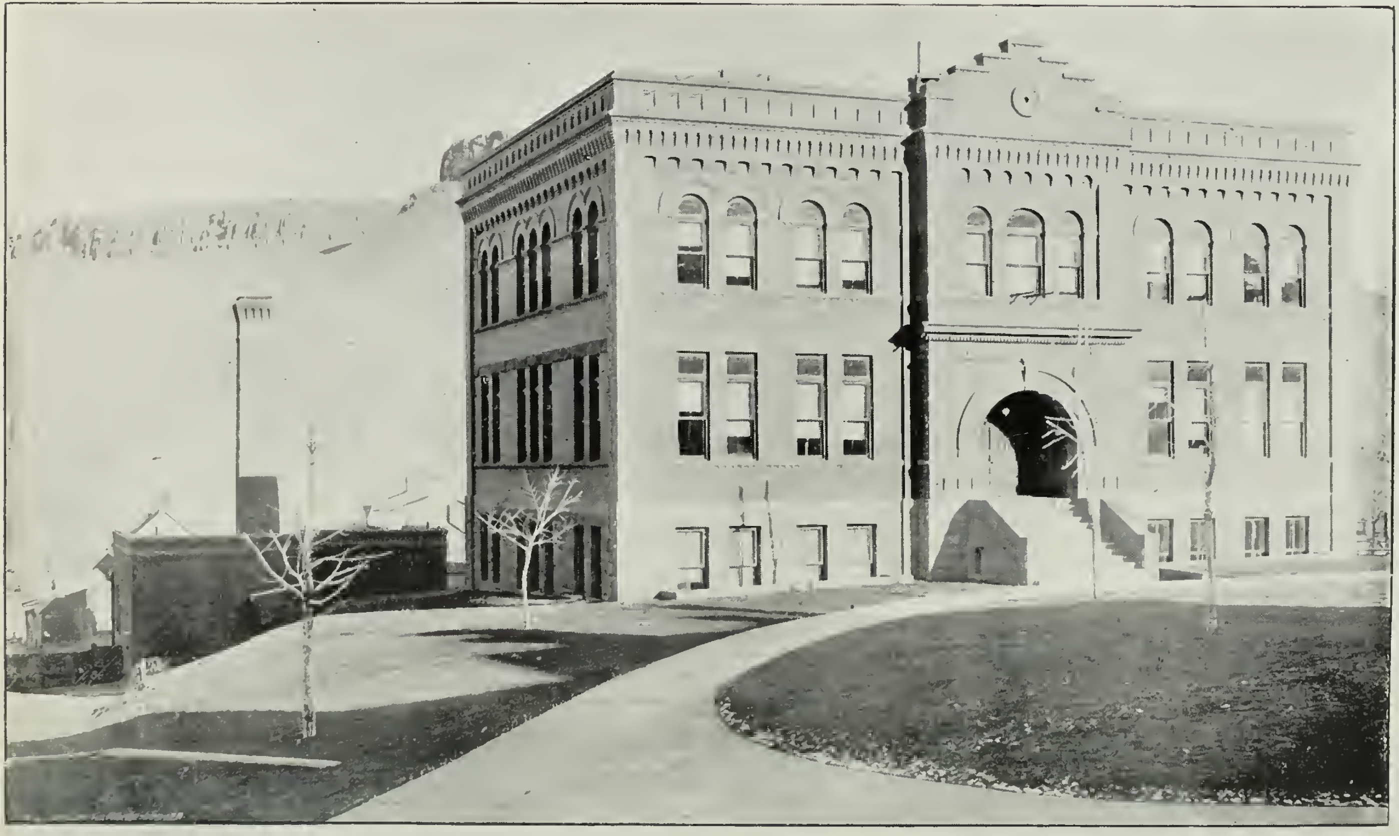
In 1897 it became evident that the space available had again become insufficient, and a radical alteration of the largest building (1890) was carried out, a story being added, giving space for one of the finest draughting rooms in the West.

In 1900 Mr. W. S. Stratton, by his gift of twenty-five thousand dollars, enabled the trustees to build the Assay Department, hereafter described, and to wholly reconstruct the chemical laboratories. M. Guggenheim's Sons have contributed one thousand dollars to this fund, a part of which has been used for the purchase of additional land.

These visible additions to the material "plant" have been accompanied by successive advances in standard and method, probably greater in a relative sense than the increase in numbers or in appliances.

At the present time, applications for admission are in excess of the accommodations, and applicants are advised not to delay sending in their names. As shown on page 8, a large proportion of the students are from outside of Colorado.

The record of the graduates, as a body, is perhaps the most gratifying feature in the history of the Colorado School of Mines. Numbering at present over two hundred, and occupying, as most of them do, positions demanding skill and responsibility, they form the best evidence that the institution has its place among technical schools of the first rank.



ENGINEERING HALL. 1894.

LOCATION.

The institution is located at the City of Golden, sixteen miles from Denver, on the line of the Colorado and Southern Railroad, or a trifle over thirteen miles by the Denver, Lakewood and Golden Railroad. Trains of the former road leave Denver from the Union Station. The Denver, Lakewood and Golden leaves (by electric car) station on Arapahoe street, Denver, between Fourteenth and Fifteenth Streets.

The altitude of Golden is five thousand seven hundred feet above sea level, or about four hundred and fifty feet higher than Denver.

The town lies close to the first foot-hills of the Rocky Mountains, but can hardly be considered as a "mountain town," though within an hour's ride, by rail, of some of the well-known mining camps of the region.

No place in Colorado has a better health record than Golden. The climate is invigorating and pleasant, with open winters, and a large proportion of clear days.

The surrounding region is rich in the characteristic scenery of the Rocky Mountain region. The famous Clear Creek Canon begins at the town of Golden, and within a few miles may be found many points of view which the railroad tourist travels to see imperfectly from the car window.

Probably no locality in the United States could be found richer in geological illustrations of the formations of various ages, affording abundant opportunity for practical instruction, as well as exercise.

EXPENSES.

Tuition is free to *bona fide* residents of Colorado. Students from other states pay fifty dollars a term. All are charged with material consumed or broken.

The following are the various fees and charges:

Matriculation fee (paid upon admission)	$5.00
Damage fee	5.00
Athletic Association, annual dues	5.00
Locker fee (paid once only, for the course)	1.00

The damage fee is not annual, but is regulated according to actual damage chargeable to students. It is expected that the proceeds of this fee from new students will meet the outlay each year, so as to make the original payment of five dollars the only one necessary during the entire course.

Of the other expenses a part, as shown below, are school charges, for such material or wear and tear, as belong to the school issue of apparatus and supplies. Text books and drawing instruments and supplies are not charged in school accounts, but are inserted in order to give a fair idea of the total expense, exclusive of board, etc.

FRESHMAN CLASS

Qualitative Analysis, fee	$20.00
Qualitative Analysis, deposit (apparatus)	15.00

(These are second term charges. The "deposit" is often not consumed, in which case the balance is returned. The "fee" is also for material, chiefly chemicals. No part of it is returnable.)

Texts for Freshman course (both terms)	$15.00
Drawing Instruments	11.50
Supplies in Drawing Department	8.50

SOPHOMORE CLASS.

Quantitative Analysis, fee (for the year)	$20.00
Quantitative Analysis, deposit	15.00
Assaying, deposit	25.00
Supplies in Drawing Department	5.00
Blowpipe outfit (Mineralogy)	12.00
Text books for the year, total	15.00

JUNIOR CLASS.

Surveying Course (use of instruments)	$10.00
Supplies used in same course	2.00
Text books for the year	35.00

SENIOR CLASS.

Graduation fee	$ 5.00
Text books for the year	12.00

There are other expenses incidental to mining and metallurgical trips, some of which are obligatory. The total for the entire course is always within one hundred dollars, but is necessarily variable.

The preparation of theses (Senior) involves expenses, which vary greatly according to the nature and treatment of the subjects. For laboratory work a deposit of fifteen dollars is made.

Students leaving in mid-term are not entitled to return of fees, except on account of sickness.

All charges are payable in advance.

The expenses of the school year (tuition fee excluded) need not exceed three hundred and fifty dollars. Board and good accommodation can be had at from four to six dollars a week.

Many applicants write asking whether the institution can furnish employment, or whether work may be secured in Golden, to aid them in meeting expenses. The school, however, cannot employ students, and the chances for employment in Golden are very slight.

It should be added that the course is far too exacting to allow any student time for outside work.

REQUIREMENTS FOR ADMISSION.

Candidates must be at least seventeen years of age. They must sustain examinations in English, Geography, History, Algebra, Geometry and Zoology.

In Algebra, the first eighteen chapters of Wentworth's Higher Algebra or an equivalent.

The whole of Plane and Solid Geometry. Applicants are expected to show clear notions of the nature of Geometrical reasoning. Some original work is given in each paper. All applicants, graduates of High Schools not excepted, are examined in Solid Geometry.*

English, Geography and History of High School standard are required.

In English exercises are given in writing from dictation, pronunciation (diacritical marks), definitions and correction of phrases. No formal examination is given in Literature nor in Grammar. Lewis' "First Book in Writing English" is recommended for preparation.

The paper in Geography includes general, physical and political divisions of that subject.

The paper in History includes General History and United States History. In the former Myers, in the latter Channing, or their equivalents, may be made the bases for preparation.

The composition, chirography and general style of the three last mentioned papers will be considered in judging the candidate's fitness in English.

In Zoology Steele's is recommended for preparation. Applicants not prepared in this topic are nevertheless admitted, provision being made for their instruction, though not by members of the Faculty. The fee for this course depends upon the number conditioned, and is usually about three dollars.

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* Not including Conic Sections.

Applicants are warned of the great risk attending attempts at self-preparation.

Diplomas of accredited High Schools, bearing date not earlier than the year preceding application, are accepted for admission to Freshman class, except in Solid Geometry.

Candidates for advanced standing will be examined in all studies of the course below the class applied for, unless they can present credits sufficient, in the opinion of the Faculty, for admission without examination.

The Faculty reserves the right, however, to examine for admission to any higher standing than the first term of the Freshman year, irrespective of the credits brought from another institution. Those whose credits for a given class are only partial, cannot be admitted to such class unless they also present credits for a portion of its work, thus providing time in which to make up the deficit.

It is necessary for all such applicants to bring with them the work they have executed in Mechanical Drawing and in Descriptive Geometry.

Examinations may be taken at the homes of the applicants, papers being forwarded to some responsible examiner. This applies to Freshman admissions only.

All candidates for admission are advised to take the June examination.

An applicant who has passed his entrance examinations or presented an approved diploma, is put upon the "accepted" list, and so notified. But he is not "admitted" until his matriculation fee is paid. The large number of admissions hitherto of applicants who never appeared at the school renders this regulation imperative.

The experience of several years has shown that any student entering with less than the equivalent of a good High School course, *and that, too, thoroughly mastered,* has little chance for success.

COURSES AND DEGREES.

There are two full courses of study, viz., Mining and Metallurgical Engineering, and Electrical Engineering. Each covers a period of four years. The studies, however, are identical during the first year of all courses, beginning to diverge at the opening of the second year.

The degrees given are:

Engineer of Mines and Metallurgy (E. M.)
Electrical Engineer (E. E.)

Students cannot make any variation or division in the regular course during the Freshman year. In the upper classes they may, subject in each case to approval by the Faculty, divide a year, *i. e.,* take two years time for the work of a single year. This privilege, however, is subject to the invariable condition that the mathematical studies shall be taken in the first of the two years, and the chemical or other work in the second. The Faculty also reserves the right to require the repetition in the second year of any or all of the work gone over in the first year.

No special or partial students are admitted, except as Post Graduates.

There are no special *courses.* Post Graduate students attend lectures or practical work with regular classes, and are "specials" only in the sense that they may omit certain lines, and are not confined to the course of any one class.

Fire assaying is excluded from these special or partial post graduate courses, unless the student is a candidate for a degree, and is taking all the other work required.

EXAMINATIONS AND CONDITIONS.

Regular examinations, which all students are required to attend, are held at the end of each term, on the various subjects pursued during the term. Upon the completion of any branch of study, the student will be subjected to a rigid examination upon the whole subject.

Absence from examinations, whether from illness or from any other cause, can be excused only upon presentation of satisfactory reasons to the President of the Faculty.

No student can present himself for examination in any subject who has not attended at least eighty per cent. of the lectures or other exercises on that subject.

Students failing to attend examinations for the removal of conditions cannot be re-examined, but must repeat the year.

A condition incurred during the first term may be removed by a first re-examination, held before the end of the second term, at a regular date set for that purpose, and in case of failure to pass, by a second re-examination, held in September at a regular date set for that purpose, before the beginning of the term, and until so removed, the said condition shall remain in effect.

A condition incurred during the second term may be removed by a first re-examination, held at a regular date set for that purpose, before the opening of the school in September, and in case of failure to pass, by a second re-examination, held before the end of the first term of the next school year, at a regular date set for that purpose, and until so removed, said condition shall remain in effect.

The passing mark on all re-examinations shall be five units higher than that upon the first examination.

Any student having at the end of a term more than two conditions, shall be relegated to the next lower class.

A complete failure in any subject may relegate a student to the next lower class.

(a) A failure to pass a second re-examination shall constitute a complete failure.

(b) An average mark of forty or less on the whole work in any subject shall constitute a complete failure.

(c) The absence of any student from twenty per cent. or more of the prescribed work in any subject shall constitute a complete failure.

Any student failing to maintain a reasonable standing will be dropped from the course.

No student may enter the Sophomore or Junior class with more than one condition.

No student may enter the Senior class with any condition.

Any member of the Senior class not in full standing in every subject at the time of the regular meeting of the Faculty in April shall be debarred from graduation.

When any prescribed trip is undertaken, having a practical bearing on the work of any course, the students in that course, and working for a degree to which that course is essential, shall be required to attend such trip, unless excused by a vote of the Faculty.

The attempt of any student to present as his own the work of another, or to pass any examination by improper means, will render him liable to expulsion.

All instruments belonging to the school are intended solely for use in class instruction, and will not be loaned to students or others. This regulation holds during vacation as well as in the active school terms.

THESES AND GRADUATION.

A thesis upon some practical subject is an important prerequisite to graduation.

Part of the work consists in visiting mines, smelteries, power plants and other works where the processes lectured upon may be seen in actual operation. Short trips of this description are frequent, while once a year a longer one is arranged, usually to some noted mining section.

Expeditions of this kind afford abundant opportunities for the student to collect materials suitable for memoirs and theses.

All memoirs, theses and drawings which constitute a regular part of the school work, may be retained by the institution, and preserved as a part of the permanent record of the student who executed them.

Each Senior shall submit to the Faculty, not later than November 1st, the subject of his thesis, which subject must be approved by the proper Professor. Each thesis must be type-written or printed, on 8½x11-inch paper, and bound in book form.

The completed theses must be handed in not later than May 15th.

Theses must be completed in final form, and handed to the librarian, before the delivery of diplomas. No diploma will be delivered until this requirement has been met.

No student will be allowed to graduate while indebted to the school.

SCHEDULE OF STUDIES.

FRESHMAN YEAR.

FOR ALL COURSES.

FIRST TERM.

Algebra	5 hours a week.
Trigonometry	3 hours a week.
General Chemistry	4 hours a week.
Descriptive Geometry	2 hours a week.
Drawing	15 hours a week.

SECOND TERM.

Analytical Geometry	3 hours a week.
Algebra	5 hours a week.
General Chemistry	4 hours a week.
Descriptive Geometry	2 hours a week.
Drawing	6 hours a week.
Qualitative Analysis	12 hours a week.

COURSE IN MINING AND METALLURGY.

SOPHOMORE YEAR.

FIRST TERM.

Calculus	3 hours a week.
Analytical Geometry	2 hours a week.
Mineralogy	5 hours a week.
Physics	4 hours a week.
Physical Laboratory	2 hours a week.
Mechanism	1 hour a week.
Quantitative Analysis	12 hours a week.
Mechanical Drawing	4 hours a week.
Chemical Analysis (Lectures)	1 hour a week.

SECOND TERM.

Calculus	5 hours a week.
Mineralogy	10 hours a week.
Physics	4 hours a week.
Physical Laboratory	2 hours a week.
Volumetric Analysis and Fire Assaying	8 hours a week.
Drawing	3 hours a week.
Mechanism	1 hour a week.

COURSE IN MINING AND METALLURGY.

JUNIOR YEAR.

FIRST TERM.

Geology	4 hours a week.
Mechanics	3 hours a week.
Surveying	3 hours a week.
Surveying (Field Work)	9 hours a week.
Metallurgy	3 hours a week.
Machine Design	2 hours a week.
Machine Design (Drawing)	6 hours a week.

SECOND TERM.

Geology	3 hours a week.
Mechanics	3 hours a week.
Metallurgy and Ore Dressing	3 hours a week.
Surveying	2 hours a week.
Surveying (Field Work)	9 hours a week.
Graphics	2 hours a week.
Graphics (Drawing)	3 hours a week.
Machine Design	1 hour a week.
Machine Design (Drawing)	3 hours a week.

COURSE IN MINING AND METALLURGY.

SENIOR YEAR.

FIRST TERM.

Metallurgy	4 hours a week.
Mining	5 hours a week.
Hydraulics	5 hours a week.
Theory of Construction	2 hours a week.
Mining and Metallurgical Design	6 hours a week.
Hydraulic Laboratory	2 hours a week.
Theoretical Chemistry	1 hour a week.
Testing Laboratory	2 hours a week.

SECOND TERM.

Metallurgy	4 hours a week.
Mining	5 hours a week.
Power Transmission	5 hours a week.
Technical Chemistry	1 hour a week.
Steam Engine Laboratory	2 hours a week.

COURSE IN ELECTRICAL ENGINEERING.

SOPHOMORE YEAR.

FIRST TERM.

Calculus	3 hours a week.
Analytical Geometry	2 hours a week.
Physics	4 hours a week.
Physical Laboratory	4 hours a week.
Mechanism	2 hours a week.
Chemical Analysis (Lectures)	1 hour a week.
Quantitative Analysis	12 hours a week.
Drawing	6 hours a week.

SECOND TERM.

Calculus	3 hours a week.
Analytical Geometry	2 hours a week.
Physics	4 hours a week.
Physical Laboratory	4 hours a week.
Mechanism.	2 hours a week.
Drawing	9 hours a week.
Shop Work	6 hours a week.

COURSE IN ELECTRICAL ENGINEERING.

JUNIOR YEAR.

FIRST TERM.

Dynamo Machinery	4 hours a week.
Dynamo Laboratory	8 hours a week.
Calculus	5 hours a week.
Mechanics	3 hours a week.
Machine Design	2 hours a week.
Machine Design (Drawing)	8 hours a week.
Electrical Measurements	4 hours a week.
Differential Equations	2 hours a week.

SECOND TERM.

Dynamo Machinery	4 hours a week.
Dynamo Laboratory	8 hours a week.
Mechanics	3 hours a week.
Batteries	2 hours a week.
Precision of Measurements	2 hours a week.
Electrical Design	4 hours a week.
Electrical Measurements	10 hours a week.
Testing Laboratory	1 hour a week.

COURSE IN ELECTRICAL ENGINEERING.

SENIOR YEAR.

FIRST TERM.

Hydraulics	4 hours a week.
Transformers and Alternating Currents	5 hours a week.
Dynamo Laboratory	8 hours a week.
Electrical Design	6 hours a week.
Photometry and Electric Lighting	2 hours a week.
Laboratory Work in Photometry	3 hours a week.
Hydraulic Laboratory	1 hour a week.

SECOND TERM.

Power Transmission	4 hours a week.
Electrical Transmission	3 hours a week.
Steam Engine Laboratory	3 hours a week.
Electrical Design	6 hours a week.
Thesis Work	15 hours a week.

DEPARTMENTS OF INSTRUCTION.

CHEMISTRY.

President Chauvenet. Prof. Hartman. Mr. Test.

Much time is devoted to the study of general and analytical Chemistry. The course in general Chemistry, which includes a discussion of its fundamental principles, nomenclature and the use of symbols and equations, runs through the Freshman year. It comprises four lectures weekly, fully illustrated by experiments, sixteen written "quizzes," and two general examinations.

An advanced course, dealing with historical, theoretical and applied Chemistry, is given during the Senior year. In connection with these courses, the subject of stoichiometry is thoroughly taught by lectures and recitations, with numerous exercises in calculation. This work is not confined to purely chemical calculations, but includes also metallurgical and physical features, such as the metric system, specific gravity, density and tension of gases, calculation of formulæ and analyses, slag calculations, and generally all applications of elementary Mathematics to chemical and metallurgical problems.

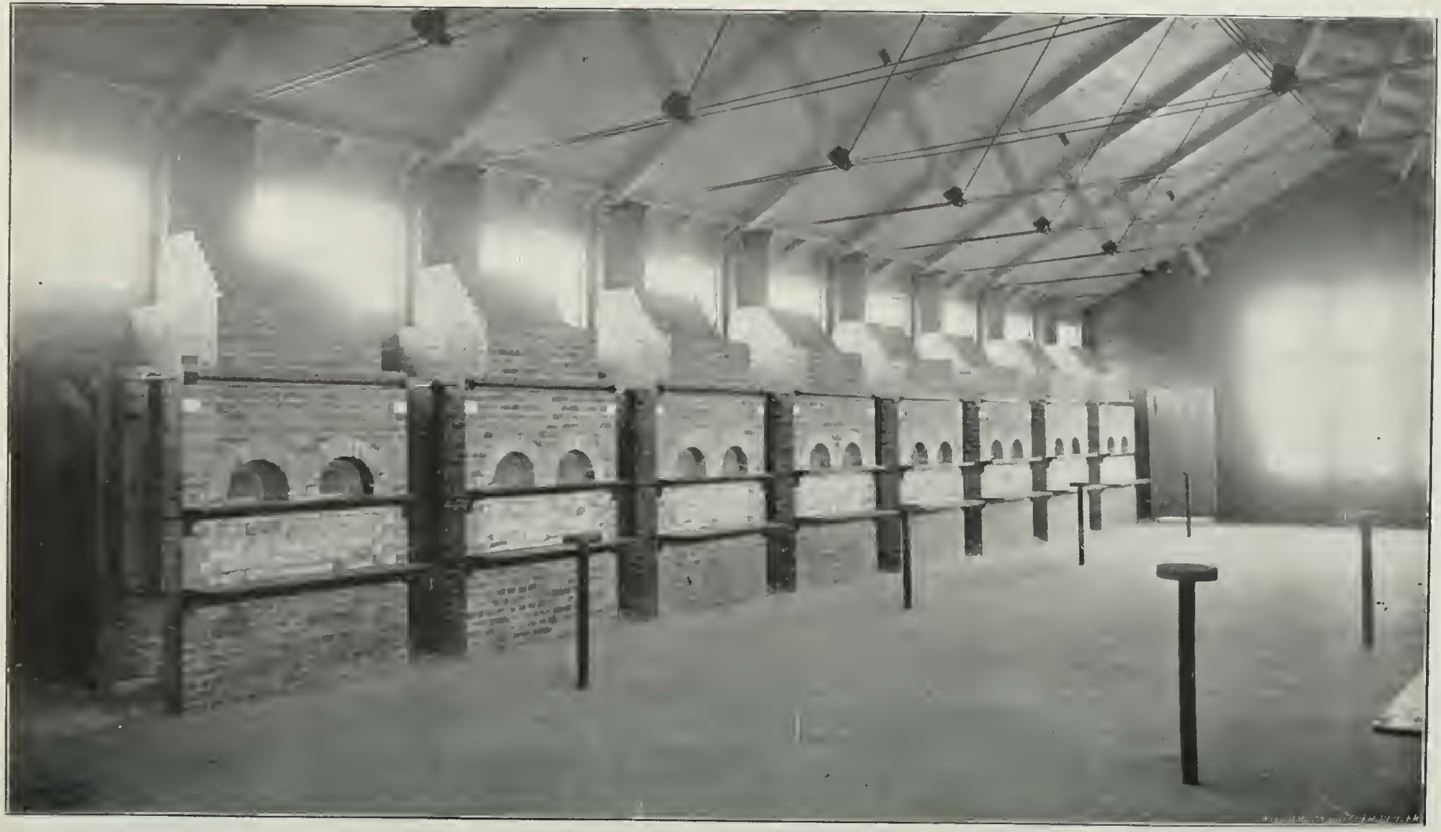
ANALYTICAL CHEMISTRY.

The courses in analytical Chemistry begin in the second term of the Freshman year, with an exhaustive course in qualitative analysis, requiring ten hours weekly, in which the reactions of all the more common elements and radicals are studied and their identification in mixtures of varying complexity, is taught. Identification of rare elements and spectroscopic analysis, are included in the course, which is further supplemented by lectures on principles and methods.

The study of quantitative analysis is carried on during the entire Sophomore year, seven hours weekly being required. The first term is devoted more particularly to the study of gravimetric methods, passing from the analysis of simple salts to difficult separations in minerals and alloys. The second term of the Sophomore year is devoted to the study of the rapid volumetric methods favored in the West. A large stock of checked ores of various kinds is available, and the work is made eminently practical. When time permits the study of electrolytic methods, iron and steel analysis, gas and water analysis, and other advanced work may be taken up.

The work of the chemical department has been greatly facilitated by the complete rehabilitation of the laboratories. They are equipped with modern tile-topped desks, fitted with gas and sinks. There are also improved systems of heating and ventilation, numerous hoods, mechanical blast and suction, drying closets and other improvements, making the laboratories of the School equal to any in the United States. These laboratories occupy nearly the whole of the building of 1880-1882, and will accommodate at least one hundred and sixty students at one time. In addition to the two large laboratories, devoted to general use, there are balance rooms, private and research laboratories, and supply rooms, which meet all possible requirements.

All students in laboratory courses must, in addition to payment of desk fees, make a deposit with the Registrar before receiving apparatus and supplies. In case of excessive withdrawal of apparatus a second deposit may be called for. No fee for less than an entire term's work is accepted. Students are not permitted to do any analytical work except that outlined in the regular courses, or in assigned theses, whether for fees or gratuitously. All work must be done at the suggestion and under the direction of the professor in charge.



INTERIOR OF ASSAY LABORATORY

FIRE ASSAYING.

Prof. Rose. Mr. Test.

Through the generosity of Mr. W. S. Stratton, of Colorado Springs, the Board of Trustees has just completed the largest laboratory for fire assaying of any institution in the United States. The building is 92 by 46 feet, having thirty-two muffle furnaces with space for sixteen more, well equipped parting room, balance rooms, office and store room. Each student has his own muffle, coal bin, and desk room conveniently arranged with regard to his furnace.

Fire assaying is taken up by sections running through the Sophomore year. The principles of fluxing are first taught, followed by their application to typical ores, siliceous, barytic and pyritic. The course involves thorough work in the assay of rich, medium and low grade ores of lead, gold and silver. The nitre, nail and roasting methods are required, and the results compared. The course includes also copper mattes, bullion by scorification, and combined wet and dry methods; silver bullion by wet and fire methods; and gold bullion.

Large numbers of checked samples are given to students, and it is believed that no technical school in the country exacts such an amount of actual practice as is here insisted upon, before the student is pronounced fit for a practical assayer. No term passes without applications to the institution for assayers or chemists. Nearly every large reduction works in the region has one or more of our graduates in its employ.

The department desires to acknowledge courtesies and gifts of samples from the O. & G. S. and R. Co.; E. E. Burlingame, of Denver; The State O. S. Co., of Black Hawk; the Pueblo S. & R. Co., and Colo. Sm. Co.; the Bimetallic and Ark. V., of Leadville; Taylor and Brunton Sampling Works; Eagle Sampling Works, of Victor; Aspen mine, and Arequa Mill of Cripple Creek.

METALLURGY.

PROF. ROSE. PREST. CHAUVENET.

The study of Metallurgy begins with the Junior year. and continues throughout the remainder of the school course. The subject is taught by illustrated lectures, study of text books, and visits to metallurgical works, where the students see and study the operations described in the class room.

JUNIOR YEAR.

General Principles of Metallurgy—Historical sketch. The relations of Chemistry to Metallurgy. Properties of the metals. Alloys, brasses and bronzes. Thermo treatment of metals.

Fuels (solid, liquid and gaseous), their occurrence, manufacture and uses.

Refractory materials, their occurrence, properties, manufacture and uses. Pyrometry.

Furnaces, different types used for various metallurgical operations. Blowing apparatus. Hot-blast stoves.

Fluxes, including the study of slags and calculation of furnace charges. Typical metallurgical processes.

Sampling of Ores and Metallurgical Products.

Roasting of Gold, Silver, Copper, Lead, Zinc and Iron Ores.

Metallurgy of Iron and Steel—The ores of iron and their impurities. The metals, iron and steel, their chemical and mechanical properties, as affected by process of manufacture or by impurities. The blast furnace. Manufacture of steel by the Bessemer process and its modifications.

SENIOR YEAR.

Copper Smelting and Refining—Smelting in reverberatory and blast furnaces.

Pyritic smelting.

Refining of mattes by various processes.

Electrolytic refining.

Wet Processes.

Metallurgy of Lead—Smelting in reverberatory furnaces, in the American ore hearth, and in blast furnaces. The desilverization of base bullion. Cupellation.

Metallurgy of Gold—Occurrence and properties. General discussion of various processes for extraction from ores.

Extraction by amalgamation. Arrangement of plant, and description of typical mills.

Chlorination process.

Cyanide process.

Melting and refining of gold, and parting of gold and dore bullion.

Metallurgy of Silver—Occurrence and properties. General discussion of various processes for extraction from ores.

The Patio process. The pan amalgamation process. The combination process. Chloridizing roasting and pan amalgamation.

The Boss process. Wet processes. Refining silver bullion.

Metallurgy of Zinc, Tin, Aluminum, Mercury, Antimony and Platinum.

Purchasing and Testing of Ores—A series of lectures is given, followed by practical work in the laboratory. (See "Graduation Theses.")

Graduating Theses—Students who choose a metallurgical subject for their graduation thesis are given a typical ore of gold, silver, lead or copper, which they test, and determine the most profitable method of treatment to be adopted under the given commercial conditions. The student having selected a method of treatment, then prepares working drawings and specifications for a plant to treat the given ore. The drawings, specifications, and a summary of the tests constitute the thesis necessary for graduation.

This course is given by lectures abundantly illustrated by lantern slides and supplemented by visits to the iron, lead and copper smelting works of Pueblo; lead and copper smelters of Denver and Leadville; cyanide plants of the Cripple Creek district, zinc works at Canon City, and various concentration and sampling works throughout the State. The text-books and books of reference used in this course are:

"Introduction to Metallurgy"--Roberts-Austen.
"Modern Copper Smelting"---E. D. Peters, Jr.
"Metallurgy of Lead"--------H. O. Hofman.
"Metallurgy of Lead"--------Collins.
"Metallurgy of Gold'---------T. K. Rose.
"Metallurgy of Gold'---------Eissler.
"Metallurgy of Silver"-------Eggleston.
"Metallurgy of Silver"-------Collins.
"Handbook of Metallurgy"----Schnabel.

In addition to these regular texts, numerous references are made to current technical literature.

MINING AND METALLURGICAL EXCURSIONS.

Visits to local mines and metallurgical plants are of weekly occurrence during the last two years of the course. In addition to these the Senior class makes two excursions to more distant plants. The first of these takes place in the fall just previous to the opening of the school year, and the second shortly before commencement. *These trips are required of all Senior candidates for the Mining and Metallurgical degree.*

During the fall of 1900 the class visited the chlorination mill at Colorado City, and the iron and lead smelters at Pueblo. In the spring of 1901 two weeks were devoted to a careful study of the mines, mills and power plants of the Cripple Creek district. The geology of the district also received careful attention.

On these trips the students are accompanied by two or more professors, and the visits are carefully scheduled. The inspection of the various works is accompanied by lectures on the ground, by the professors in charge.

Many students work during the summer months in mines or mills. Though this is no part of the course, students in the upper classes are urged to avail themselves of these opportunities.

The institution is greatly indebted for facilities furnished by Mr. Frank Trumbull, President of the Colorado & Southern Railroad.

METALLURGICAL MODELS AND MATERIALS.

The school has the advantage of a fine collection of models from the works of Theodore Gersdorf, Freiberg, Saxony, illustrating the best types of furnaces in this country and Europe. Each model is made to a scale and is complete in every detail. The following furnaces are represented:

Long hearth roasting furnace, for silver, lead and copper ores.

American lead-silver furnace, as used in Colorado smelters.

Round silver-lead furnace, as used in Germany.

Small round silver-lead furnace, of type used with scant water supply.

Complete "plant" for refining "base bullion," including the following models:

Softening furnace in Parks' process, as used at Pueblo, Kansas City, St. Louis, etc.

Zinc pots as used in same.

Sweating furnace as used in same.

Lead pots as used in same.

Concentration cupel for making silver bullion.

Belgian zinc furnace, as used in Missouri, New Jersey and Belgium.

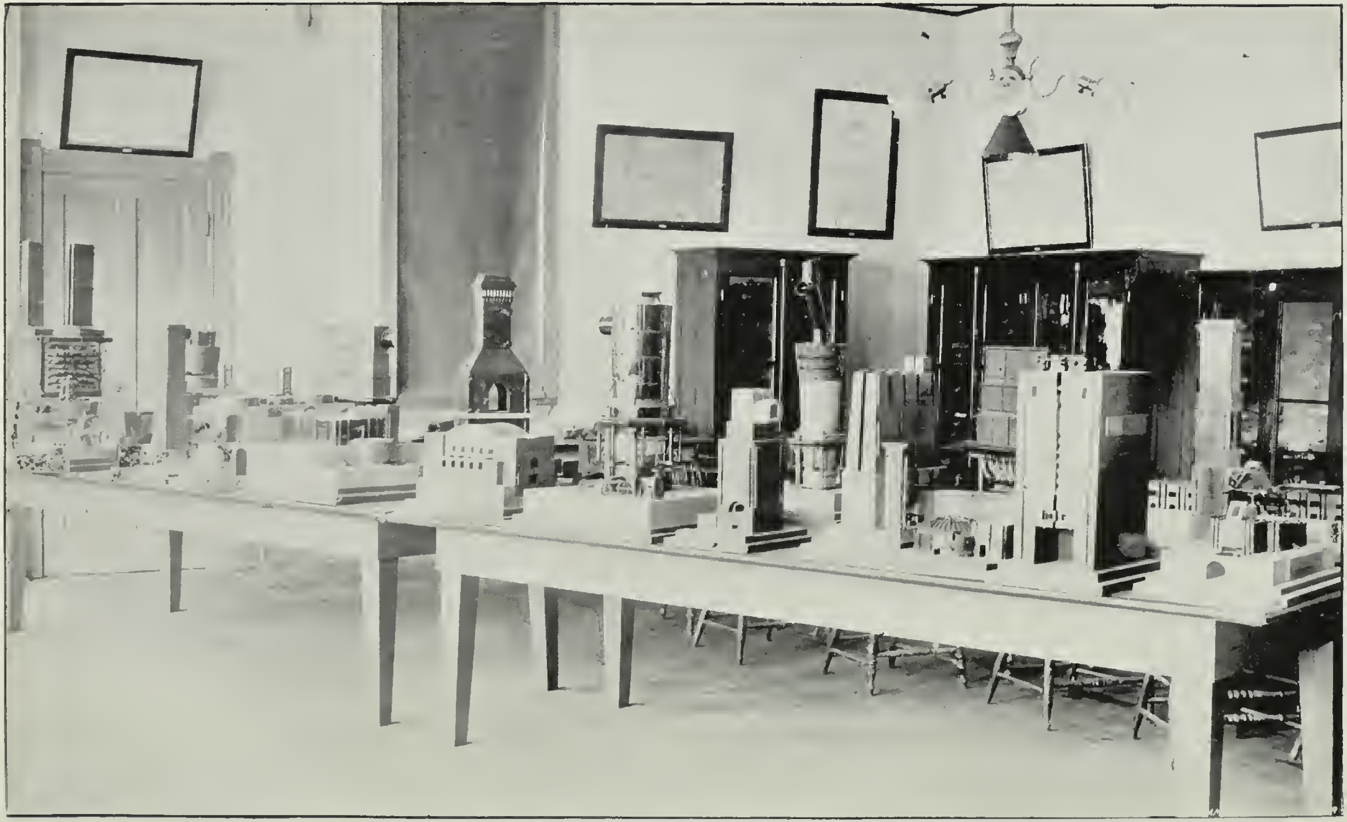
Silesian zinc furnace, as used in parts of Europe.

Silver amalgamation pan (working model), as used in United States.

Copper reverbatory furnace, as used in Montana, Colorado, etc.

Gerstenhofer roasting furnace, for fine copper and iron sulphides.

Tin blast furnace, as used in Saxony.



GROUP OF METALLURGICAL MODELS.

Bismuth smelting furnace, as used in Germany.

Large mercury furnace, as used in Almaden, Spain.

Fume furnace, for making lead and zinc paints.

A handsome addition to these models is due to the liberality of Mr. John W. Nesmith, President of the Colorado Iron Works. It includes:

1. Working model of twenty-stamp mill, on scale of one and one-half inches to the foot.
2. Working model of ore rolls, same scale.
3. Working model of a Dodge crusher.
4. Model of modern blast furnace for lead-silver ores, with water jacket.

In addition to the above there is a large number of smaller models, being the complete set used in the famous Keyes and Arents lead-well suit.

In Colorado students have unusual opportunities for the practical study of metallurgical operations on a large scale. Denver is not only the mining center of the United States, but the business of treating silver and gold ores by lead smelting is carried on by large plants in Denver and Pueblo, on a scale unequaled in any other part of the world.

In the State, within easy reach, metallurgical and mining work of every description is in active operation.

Coal mining, coke and charcoal manufacture.

Brick and tile works.

Iron blast furnaces, and Bessemer steel works.

Gold, silver and lead mining, gold placer mining. Gold milling, concentration milling, lixiviation, wet processes for gold, ore sampling works, iron foundries and machine shops, with manufacturing establishments in great variety.

The lectures are richly illustrated by lantern exhibits of views and designs of metallurgical works and appliances.

ORE DRESSING.

Prof. Comstock.

This subject comprises a study of the mechanical operations which ores undergo preparatory to metallurgical treatment. It begins with a detailed study of the relations between a solid particle and a fluid, either at rest or in motion, and the principles so developed are applied to the various concentrating devices in use. The principles involved in the different types of crushing and grinding machines are considered at some length. This work is illustrated by facts and figures collected from practice in the numerous dressing works of this region, and supplemented by visits to the mills of the immediate neighborhood of which there are many.

No text is used for the class room work. The subject is taught by lectures in which a free use is made of lantern slides, drawings and photographs. The School is also supplied with a large collection of concentration products from various mills in the State. These comprise headings, tailings and intermediate products from machines treating different sizes and classes of material, and are of great value to students in this course.

The laboratory, in which all students do some work in ore dressing, contains a crusher, a sample grinder, a Vezin laboratory jig and a Wilfley table. A motor and counter shafting are so arranged that this machinery can be run at any speed and continuously for any desired length of time.

It is believed that the course as here arranged fits the students to undertake the study of the difficult problems in concentration, which every mining camp presents sooner or later and to solve many of them successfully.

The course in ore dressing is given in the Junior year.

MINING.

Prof. Comstock.

This subject is taught by lectures illustrated by lantern slides, photographs and drawings. Five lectures per week are delivered during the Senior year. In addition to the class room instruction, two afternoons per week are devoted to the detailed design of a plant for the development of a mine, the ruling conditions being specified.

The outline of the course is as follows:

Ore Deposits—Their classification, modes of formation and economic study. Description of typical deposits.

Boring—Diamond drill work and the percussion methods.

Breaking Ground—Hand tools, rock drills, channellers, coal cutters, steam shovels and dredges.

Explosives—Black powder, nitro-glycerine, gun-cotton and their compounds; methods of testing and calculations of heat and pressure developed. The wave of explosion and the theory of blasting. Pointing and charging holes. Methods of firing.

Shaft-Sinking, Tunneling and Supporting Excavations—Method of sinking and driving in loose and running ground. Linings of wood, metal and masonry, their relative strength, cost and durability. Timbering of stopes and other working places and preservation of timber.

Exploitation—Systems of mining in beds and veins. Descriptions of the special methods adopted for working bodies of soft ore and large masses.

Transportation—Underground and surface. Vehicles and motive powers. Self-acting and engine planes and haulage by the tail rope and continuous rope systems. Electric haulage. Surface tramways and aerial ropeways.

Hoisting—Receptacles, ropes, gallows frames and motive powers. Safety appliances. Pneumatic hoisting.

Drainage—Sources of mine water. Dams and drainage levels. Hoisting water. Direct acting and Cornish pumps. Pumping by compressed air and electricity.

Ventilation and Lighting—Natural ventilation. Friction of air in mines. Furnaces and fans. Efficiency of ventilating apparatus. Candles, open lights, safety lamps and the electric light.

Ascent and Descent—Ladders. Buckets and cages. Man engines. Time required and consideration of the relative economy of the different methods.

Accidents—Surface and underground. Classification and mortality.

Administration—Business management and the principles of the employment of labor.

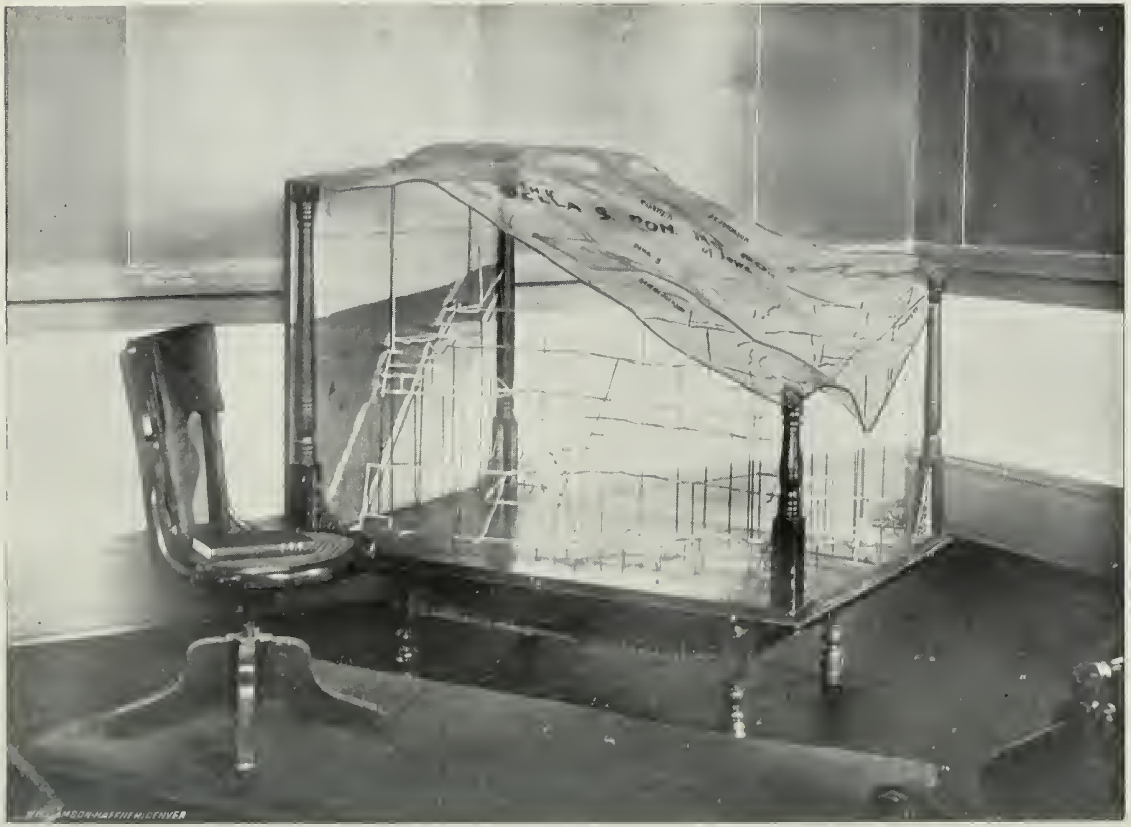
Mine Examination—Sampling of ore bodies, estimation of "ore in sight" and the valuation of mining properties.

Placer Mining—Pipe lines, nozzles and hydraulic elevators; their construction and use. Sluices—construction, length, grade and efficiency. Working dry placer ground with a steam shovel. River dredging. Cost and results.

Mine surveying is referred to elsewhere.

Throughout the course the economic questions involved are kept constantly in view. Estimates of cost are given whenever obtainable from reliable sources. Care is taken to impress upon the student that mining is a *business* and to be successful, must be conducted on business principles.

This department is indebted to the generosity of Mr. D. R. C. Brown, of Aspen, for two very elaborate and ac-



MODEL OF THE DELLA S. CONSOLIDATED MINE, ASPEN, COLORADO.

curate models showing the geological structure of the famous Aspen district and the method of developing and working the ore bodies.

One of these models is a representation on a scale of 1:400 of all the workings of the Della S. Consolidated Mining Company in Smuggler Mountain, and covers an area of about a quarter by a third of a mile. The other, on a somewhat smaller scale, consists of twenty accurate geological sections, drawn on glass, distributed over the same area. Mr. Brown has also presented to the School of Mines a series of large maps, constituting probably the most nearly perfect geological representation of the Aspen region in existence.

Mr. Frank Bulkley, Manager of the Aspen Mining and Smelting Company, has presented the department of mining with a valuable series of maps, showing the extensive workings of the properties under his control.

Through the kindness of A. Leschen & Sons, and of Broderick & Bascom, of St. Louis; the Trenton Iron Company and John A. Roebling's Sons Company, of Trenton, New Jersey, and Washburn & Moen, of Worcester, Massachusetts, the School has come into possession of a complete series of sections of all the types of wire rope now in use.

The museum of this department is supplied with a set of models, illustrating all the approved methods of mine timbering, and with a number of mine lamps showing the evolution of the modern methods of lighting. Electric blasting appliances are provided for experimental purposes and an apparatus for measuring the work developed by the decomposition of explosives has recently been constructed at the School for the use of students of the Senior class.

It is to be noted that many topics, both theoretical and practical, which are not included under the head of "Mining" in the school courses, have in fact their immediate application in practical mining. It would be an entirely misleading idea to suppose that only the Senior hours scheduled under "Mining" are devoted to that topic.

MATHEMATICS.

Prof. Stockton. Asst. Prof. Weiss. Mr. Hamilton.

The instruction in Mathematics extends through the first two years and is given by the lecture system. There are at present no regular courses in Advanced Mathematics, but such subjects are taken up from time to time in an optional course, for the benefit of students especially interested in pure mathematics.

Considerable time is devoted to the study of Algebra (see Schedule of Studies, p. 30). The course begins with a review of some of the more fundamental portions of the subject, and a thorough drill in the theory and use of determinants, after which that part of the subject usually presented in a Technical School can be given from a modern standpoint and with more than usual thoroughness.

The Trigonometry given includes the theory of Plane and Spherical Trigonometry and their application to the solution of problems. A working knowledge of logarithms and the use of tables is required.

The Analytical Geometry during the second term of the first year includes the discussion of the point, straight line and the conic sections. In the second year the course will consist of lectures on the general conic section and the elements of the Analytical Geometry of space.

The first term is devoted mainly to Differential Calculus, but the conception of the definite integral as a summation, is given, and a sufficient number of applications made to acquaint the student with the general nature and use of Integral Calculus. In the second term the problem of maxima and minima of analytical functions is treated, the necessary and sufficient conditions being established in determinant form. Most of the time in this term, however, is given to Integral Calculus. First, general methods of integration are taken up and numerous examples worked. Then the applications of integration to plane curves, areas, volumes, etc., are discussed and problems worked. Similarly, double integration as applied to areas, surfaces, volumes, moment of inertia, etc., is taken up.

DEPARTMENT OF GEOLOGY AND MINERALOGY.

PROF. PATTON. MR. EGGLESTON.

There is probably no technical school in the United States more favorably situated for the study of Geology and Mineralogy than is the Colorado School of Mines.

GEOLOGICAL LECTURE ROOM.

Located immediately at the foot-hills west of Denver, there is ready access to an almost unsurpassed series of geological sections in which all the formations from the triassic up to the recent may be readily studied. In addition to this the crystalline schists of the archæan are to be found exposed in great variety within a mile or two of the school, and the more recent volcanic rocks may be studied in the basalt and in the andesitic tufas of North and South Table Mountains, which form conspicuous features in the immediate landscape.

In the coal mines, stone quarries and fire clay beds of the vicinity, there are excellent opportunities for the study of Economic Geology, while the paleontologist has a good field for study in the famous fossil leaf deposits of the cretaceous and tertiary formations to be seen almost at the very doors of the school.

A large variety of minerals may also be collected in the crystalline rocks of the neighboring foot-hills and in the cavities in the basalt flow capping both North and South Table Mountains.

To these great natural advantages have been added very extensive geological and mineralogical collections which offer ample opportunities for study.

To the collections originally obtained by purchase from Ward & Howell of Rochester, New York, from J. Alden Smith (formerly State Geologist), from J. S. Randall of Georgetown, Colorado, and by gifts from various mines and individuals, has from year to year been added a large amount of material collected by the professor in charge and by others.

This department occupies four rooms, in all of which may be found portions of the various mineral and geological collections. These collections have been classified as follows:

First—A Mineral Type Collection, consisting of well characterized specimens to be used by the students for the purpose of study and comparison. This collection contains at present specimens representing two hundred and seventeen species and sixty-one additional varieties. These specimens come from many countries, but Colorado minerals are specially well represented.

Second—A Display Collection, mainly of large and fine specimens of minerals and rocks. Many graduates and mining men, friends of the institution, have contributed by gifts to this collection.

Third—A Supplementary Collection, containing the rarer and more expensive minerals not placed in one of the above mentioned collections.

Fourth—*A Descriptive Collection,* illustrative of the terms used in describing the various structural, physical, optical and other properties of minerals.

Fifth—*A Student's Working Collection of Minerals,* consisting of over twenty thousand unlabeled specimens, similar to those in the Type Collection, to be used by the student for study and determination.

Sixth—*A Crystal Collection,* consisting of natural crystals to be used in the determination of crystal forms.

Seventh—*A Crystal Model Collection,* containing a large number of glass and wooden models used in the study of Crystallography.

Eighth—*A Blow-Pipe Collection,* containing materials used in Blow-Piping.

Ninth—*Rock Type Collection,* containing (*a*) a collection of rocks from different countries of the world; (*b*) a series of Colorado rocks; (*c*) various rocks illustrative of structural features.

Tenth—*A Rock Working Collection,* containing miscellaneous unlabeled rocks, to be used by students in connection with the study of Lithology.

Eleventh—*A Collection of Fossils,* to be used in connection with the course in Historical Geology.

Twelfth—The United States Geological Survey educational series of rocks.

Thirteenth—Professor Patton's private collection of Minerals, displayed in the Faculty room.

Fourteenth—Professor Patton's private collection of rocks.

MUSEUM.

As is necessarily the case in a technical school, most of the collections are arranged for purposes of instruction. Such material is to be found in the numerous cases of drawers lining the sides of the rooms. The material of greatest interest to the visitor is to be found in the flat-top glass cases. This consists mainly of minerals, but in part also of Colorado fossils. The institution has at various times been presented with specimens of ore and minerals by graduates and friends. Many of these have been included in the "Type" Collection, but numbers are to be found in the museum, which has grown more rapidly during the past four years than at any previous time. The additions within the past three years include over seven hundred crystals, for the Crystal Collection, and a mass of material, estimated at over ten thousand specimens, now incorporated in the various collections, mainly in the "Working Collection."

Among the more interesting displays are quartz and microcline crystals from Florissant, Colorado; telluride gold and silver specimens from Boulder County, Colorado; beautiful golden calcites from Joplin, Missouri; the set of crystallized sulphur specimens; and many curious ores of various metals, chiefly gifts of mining friends. Above all, however, the cases of zeolites (thomsonite, mesolite, analcite, natrolite, etc.) from North Table Mountain, Golden, deserve attention. Probably no mesolites have ever been found so unique and so beautiful as are some of these specimens.

During the past two summers a very large amount of material has been collected which will be used partly for exchange and partly for incorporation in the School collections.

COURSE IN GEOLOGY.

This course runs through the Junior year and is divided into four subjects, namely: Dynamical Geology, Structural Geology, Historical Geology, Lithology. The general principles of Geology are taught through text-book (Le Conte's Elements of Geology) and lectures, supplemented by numerous field excursions.

The Rock Type Collection, Rock Working Collection, and the other collections named on pages 52 and 53, come into constant use during this course, whose intent is to make of Geology a study of practical application in connection with mining and prospecting.

The surroundings are peculiarly adapted to further this intent. The vicinity of Golden is rich in rocks of various ages, including also many illustrations of Economic Geology. Building stone, clay, limestone and coal are mined or quarried within sight of the School, while the formations include the tertiary, cretaceous, jura-trias, archæan and eruptive rocks.

The excellent and constantly growing collections of rocks make it possible to familiarize the student with all the important rock types and to make the study of Lithology a thoroughly practical one. Numerous sections of Colorado rocks have been prepared and mounted for microscopical examination.

COURSE IN MINERALOGY.

Under this head are included Crystallography, Blow-Piping and Determinative Mineralogy.

The immediate object of this course is to give the student, in a comparatively short time, a thorough familiarity with the more commonly occurring minerals, *i. e.*, with such as form the materials of rocks, or are likely to be met with in connection with mining operations.

It is quite possible so to train the powers of observation that, with the aid of a knife, pocket lens and, perhaps, of one or two other simple accessories, which can easily be carried in the pocket, one can determine on the spot nine-tenths of the minerals he meets. In the study of minerals, therefore, attention is directed mainly to the physical properties, namely, to those that can be recognized by the aid of sight and touch.

The course in Mineralogy extends throughout the whole of the Sophomore year, five hours a week being devoted to this subject the first term, and ten hours the second term. The course opens with the study of Crystallography, which requires two-thirds of the first term. The remaining weeks of the term are devoted mainly to a short course in the use of the blow-pipe, in which only such reactions are studied as are likely to be made use of in determining minerals later in the year. Determinative Mineralogy is taken up about February 1st and extends throughout the rest of the school year.

Crystallography and Blow-Piping are taught by means of lectures and practical laboratory work. In Determinative Mineralogy, lectures are made to supplement the text-book used (Moses' and Parsons' Mineralogy, Crystallography and Blow-Pipe Analysis).

SUMMARY OF COLLECTIONS WITH NUMBER OF SPECIMENS IN EACH.

Type Collection of Minerals	3,700
Working Collection of Minerals (about)	21,000
Display Collection of Minerals	1,305
Supplementary Collection of Minerals	950
Crystal Collection	1,800
Display Collection of Fossils	342
Miscellaneous Collection of Fossils	1,360
Type Collection of Rocks	1,800
Working Collection of Rocks	7,408
United States Geological Survey Educational Series of Rocks	156
Professor Patton's Collection of Rocks	1,700
Professor Patton's Collection of Minerals	970
Summary of specimens	42,491

Many recent additions are not included in this summary.

EXCHANGES.

The School has prepared a printed list of exchange material, covering both minerals and rocks. This list will be sent to all who wish to arrange for exchanges.

Correspondents should state what material they are prepared to offer in exchange, and letters should be addressed to Prof. H. B. Patton, Golden, Colo.

PHYSICS.

PROF. HILL. MR. HAZARD.

The course in Physics is given by lectures and recitations accompanied by practical work in the laboratory. The course embraces molecular physics, gravitation, mechanics of liquids and gases, elementary machines, acoustics, the theory of heat and of the steam engine, and the general principles of light.

The second term is devoted chiefly to an elementary course in electricity and magnetism.

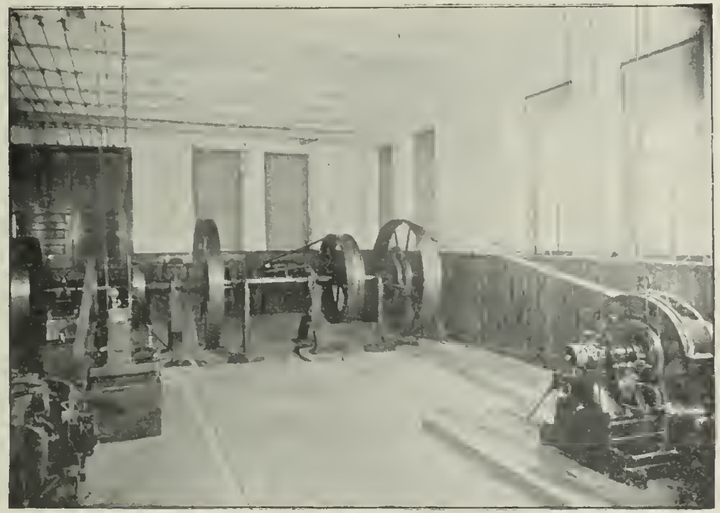
The object of the laboratory course is not original research, but the acquirement of a certain familiarity with the subjects which this work alone can give. During the first part of the course the student acquires facility in the use of instruments, and accuracy in measurement. The experiments are quantitative, and are selected with the view of illustrating the fundamental principles of the subject, rather than of devoting the student's whole time to the elaborate determination of a few constants.

The equipment is fairly complete. A fine Troemner and an excellent Sartorius balance belong to the laboratory, while a number of balances from the chemical department are available during a part of the time. Forty micrometers and vernier callipers are provided, as well as spherometers, protractors, etc. Jolly balances, hydrometers of various kinds, thermometers, a fine Kater's pendulum, lenses, mirrors, galvanometers, resistance boxes, Wheatstone bridges, apparatus for the determination of the law of the pendulum and for the determination of Young's modulus, form part of the equipment, which has received material additions during the school year just past.

ELECTRICAL ENGINEERING.

PROF. HILL. ASST. PROF. HAZARD.

The course in Electrical Engineering is intended to cover both the theoretical and practical parts of the subject. It is adapted to the needs of the State by the devotion of much time to the application of electricity to mining and metallurgy.



DYNAMO ROOM

In the third and fourth years, work in Mechanical Engineering forms a considerable part of the course. Tests of steam engines, boilers and water wheels are made from time to time. The engine is fitted up for testing, as is the eighty horse-power boiler furnishing steam to Engineering Hall. The course in Electrical Units and Measurements consists of lectures on the theory and value of the units of the science and the modern methods of measurement. Four hours per week are devoted to work in the laboratory.

The course in the Distribution of Electricity embraces distribution for lighting and the various systems for the transmission of power.

Lectures on the theory and design of Dynamo-Electric Machinery occupy the student five times a week, during the fourth year. Two full afternoons per week, in addition, are devoted to work in the laboratory and in the designing room. Alternate currents and alternate current transformers occupy a large portion of the time during this year.

The laboratory work of the fourth year consists of insulation and capacity tests, measurement and location of faults, determination of magnetization curves of iron and steel, determination of characteristic curves of various machines, and of tests of dynamos and motors, as well as standardizing and calibrating various instruments.

Besides the space occupied by the general lecture room and the Physical Laboratory, a large room is fitted up on the second floor for work in Photometry. In addition to the Bunsen photometer, a complete "Reichsanstalt" standard photometer, with all accessories, has recently been added to the equipment of this room. The various experimental machines are belted to pulleys on a jack shaft, driven by the engine in the dynamo room. The instruments for use in testing are in a smaller room adjoining, where the marble switch board and the large resistance coils are also placed. Separate wires run to each room from both the alternate and continuous current circuits and also from the sixty-cell accumulator purchased from the Electric Storage Battery Company. The rooms on the north side of the building devoted to electrical measurements, have little iron used in their construction, while the room designed for magnetic measurements has none. These rooms are equipped with piers, non-inductive resistances, gas, water and direct connections to all circuits, besides the ordinary galvanometers, resistance boxes, balances and other instruments.

The department, in addition to these appliances, is well equipped with high grade galvanometers and the ordinary apparatus for electrical measurements. Dynamometers, of various types, and wattmeters enable efficiency tests to be conveniently made. Kelvin balances, electrostatic voltmeters, ammeters and voltmeters of various makes, form part of the equipment.

Through the kindness of Gen. Irving Hale, the department has been presented with a twenty-five horse-power motor.

To Mr. Paul Webster, a former student of the institution, the department is indebted for a small steam engine.

Mr. John Pipe has recently presented the department with a dynamo of considerable historical interest.

PRIME MOVERS AND POWER TRANSMISSION.

Prof Hill.

The course of Hydraulics, given during the first term of the Senior year, embraces the study of the laws governing the flow of water in pipes, conduits and open channels, as well as the measurement of water by weirs and orifices. The class room work is supplemented by practical experiments in the laboratory and in the field. The latter part of this term is devoted to the study of pumping machinery, special attention being given to mine pumps. This department has been presented with a good collection of pumps of various makes, which will be tested by the class.

During the second term five lectures per week are given on Power Transmission and the Steam Engine. Teledynamic Transmission receives some attention, although electric and compressed air methods of transmitting power occupy most of the time.

MECHANICS.

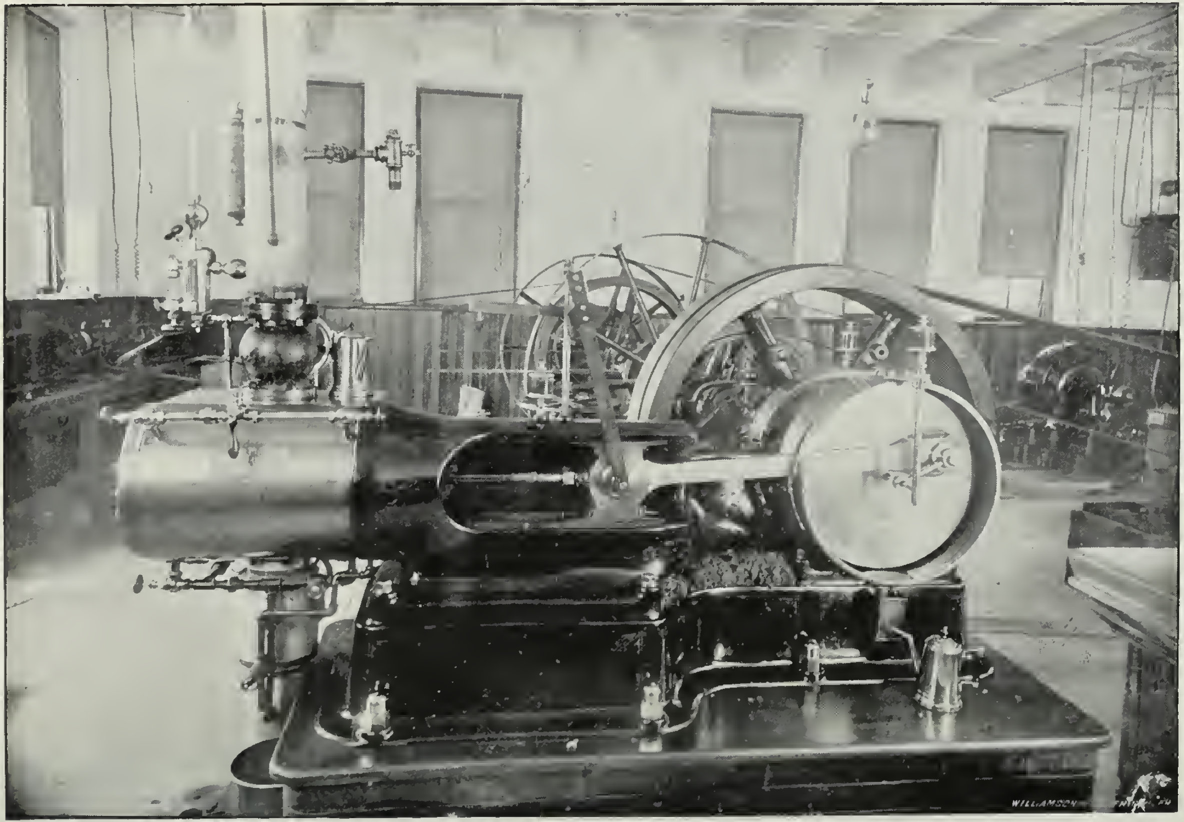
PROF. COMSTOCK.

This course occupies three hours per week during the entire Junior year. It includes Kinematics, Statics and Kinetics. In the development of formulæ and methods free use is made of mathematical ideas and symbols. A knowledge of the Differential and Integral Calculus is a necessary preliminary to the study of this subject as here pursued. The practical applications are, however, kept constantly in view and approximate methods are introduced whenever they can be shown to be sufficiently exact and to materially simplify the results. The students are encouraged in every way to rely upon their own reasoning powers, and to guard against a mere copying of book or class-room processes. They are taught to reason from fundamental principles in all cases, and to avoid "rule of thumb" work.

Great importance is attached to the study of this subject and a corresponding thoroughness on the part of the student is required. Mechanics is the basis of all successful work in the design of structures or machines, and without it the designer works in the dark. The profitable operation of many mining and metallurgical enterprises is dependent entirely upon the perfection of the mechanical appliances in use. The greatest difficulties which the engineer has to combat when he undertakes to carry on mining operations at the extreme depths now reached in many parts of the world are of a mechanical nature. Many of the reductions in the cost of ore treatment which have rendered profitable the extraction of very low grade materials, have been due entirely to the substitution of mechanical methods for manual labor.

On account of the important part which this subject plays in the professional studies of the latter part of the course, no student markedly deficient in it is considered competent to undertake the work of the Senior year.

The text-book used in this course is Ziwet's "Theoretical Mechanics."



ENGINE IN BASEMENT OF ENGINEERING HALL.

GRAPHICAL STATICS.

PROF. COMSTOCK.

Two hours per week of lecture and text-book work, and one afternoon per week of drafting are given to this subject during the second term of the Junior year. The properties of reciprocal figures, the equilibrium polygon and the frame pencil are developed and illustrated in the class-room and applied to numerous problems by the student in the drafting room. Each student determines the stresses in a number of framed structures under the various loadings to which they are subject. Roof trusses, iron building frames, gallows frames, bridge trusses, trestle bents and cranes are among the structures assigned to members of the class for analysis.

Although great importance is attached to the graphical method, the analytical determination of stresses is not neglected and at least one frame is treated by both methods and the results compared.

The effect of the rigidity of certain classes of frames upon the stresses in their members is studied, and several methods for the calculation of deflections and the stresses in redundant members are developed.

The graphical determination of bending moments in pins and shafts subject to non-coplanar forces is taken up both in the lecture and drafting rooms.

It is intended that this course shall cover the ground preparatory to actual structural design, which is taken up in the Senior year.

THEORY OF CONSTRUCTION.

Prof. Comstock.

In this course the principles and methods developed in the study of Mechanics and of Graphical Statics are applied to the design of various structures. The first lectures take up the Mechanics of Materials, including the design of beams and columns. This is followed by more complicated structures, such as wooden and steel roofs and buildings, gallows frames, trestles, flumes, masonry arches, dams, retaining walls, chimneys and foundations. Standard specifications are discussed with great care. Theories which are incomplete are supplemented by accounts of methods adopted in existing structures. Records of failures are studied, and the causes pointed out. The limitations put upon theoretical results by labor conditions, and the means available for executing the work, are considered. Economic considerations are kept in view, and students are taught that *least cost* is the first essential. The question of durability is also carefully studied.

Each student makes several designs of structures, both framed and masonry, and executes complete working drawings, bills of material and detailed estimates of cost.

Two lectures each week of the first Senior term are given to this subject. Bovey's "Theory of Structures and Strength of Materials" is used as a text.

In the laboratory each student makes a prescribed series of tests on wrought iron, steel, cast iron, wood, building stone and brick. The tests on wood are conducted by the methods of the United States Bureau of Forestry, and on all other materials by the most approved methods. The laboratory is supplied with a Riehle testing machine of one hundred thousand pounds capacity, fitted for work in tension, compression and transverse testing.

The Carnegie Steel Company, Limited, has presented to the Engineering Department a complete series of sections of structural steel.

MINING AND METALLURGICAL DESIGN.

PROF. COMSTOCK. PROF. ROSE.

Two afternoons each week during the Senior year are given to the design of a plant for the operation of a mine or for the treatment of ores. The student's preference is regarded to some extent as to the character of the plant. These designs are very complete, and involve careful study of structural, mechanical and metallurgical features. The buildings are designed in accordance with standard specifications, and rigid adherence to the best mechanical and metallurgical practice is required. A site is assigned for each plant, the student surveys it and does his work in all respects as though the structure were to be built. The problems are all different, and though the requirements correspond to existing conditions in some American mining region, they are so arranged that mere copying of a plant already built, is impossible. All work is based on careful computations, and a good reason for everything is insisted upon. Each student hands in a complete set of *working* drawings of his buildings, furnaces, etc.; detailed specifications for their construction; a bill of material for the entire plant, and an estimate of the total cost.

Among the problems recently assigned are a plant for handling fifteen hundred tons daily from a depth of three thousand feet; a lead smelting plant of one thousand tons daily capacity; a three hundred ton cyanide mill; a plant for working one of the largest mines in Cripple Creek; a five hundred-ton chlorination mill and several concentrating mills for treating assigned ores.

SURVEYING.

Prof. Stockton. Mr. Weiss.

The instruction in this course covers both the theoretical and practical part of surveying, the aim being to convey to the student a broad understanding of the subject and its special application in the professional work of the Mining Engineer.

The institution is well supplied with the necessary instruments for practical work in the field. Among these may be mentioned: Five light Mountain transits, each provided with some standard form of solar attachment; two of these transits are provided with auxiliary telescopes, for taking highly inclined sights in underground work. Also, one mining transit with top telescope, one heavy triangulation transit, one ordinary heavy engineer's transit with Saegmuller attachment, five wye levels and one needle compass, together with all the necessary accompanying apparatus, such as tapes, level rods, stadia boards, etc.

The class instruction begins with adjustment and use of the transit, and the principles of Land Surveying, the field work consisting of traverses, and various problems designed to familiarize the student with the actual handling of the transit and tapes, and to illustrate the care necessary to secure good results. The problems are all plotted and handed in, accuracy being insisted upon.

The use and adjustments of the level are treated in the same order as with the transit. After adjusting, the students are given simple exercises in differential leveling until they have become familiar with the instruments. Then some problem involving profile leveling is undertaken, such as the determination of street grades or sewer lines from the profiles. The further use of the level is left until the subject of Railroad Surveying is reached.

In Topographical Surveying, each class makes a survey of some favorable place by the transit and stadia method. From the notes taken a contour map is drawn with a view to locating the best position for a dam or reservoir site, or with a view to city improvements.

In City Surveying, classes are instructed in regard to the methods of laying out cities and towns, resurveys to locate lots described in deeds or on plats, surveys for street improvements, giving of grades, etc.

The determination of the true meridian by means of the various Solar Attachments is made clear by the discussion of the astronomical principles involved, and the adjustment and use of these attachments in the field. In this connection the method of direct solar observation for meridian is given. During the course each student is required to determine the true meridian by making an observation on the pole star; he is also required to find the latitude by an observation of the sun, using transit, solar attachment or sextant.

Mining Surveying includes the methods used in locating and patenting mining claims, and in underground surveying. Each party undertakes the complete survey of a mining claim for patent, going through all the work a U. S. Deputy Mineral Surveyor would have to do, field work, calculations and the preparation of the preliminary plat and field notes according to the requirements of the Surveyor General's office. The lectures given on this subject enter into the detail in which it is involved and touch upon the mining law relating to surveyors and the patenting of mining property.

The theory and practice of underground surveying is fully discussed, especial attention being paid to the instrumental difficulties and unique problems encountered. The field work includes the survey of some mine in the vicinity, and the making of the accompanying computation and maps.

In Geodetic Surveying, classes are instructed in the outlines of that subject, including the different kinds of triangulation, a description of the United States Coast Survey base apparatus and the establishment of stations and signals. A base line is measured with a three-hundred-foot steel tape and all corrections made so as to eliminate errors of sag, pull, temperature and grade. On this rests a system of triangulation of the neighboring peaks, all angles being measured and adjusted, and distances computed.

In Railroad Surveying, students are instructed in the theory of Railroad Curves, running of levels and the measurement of earth work. The time in the field is devoted to a projected line with preliminary and location surveys, topography, cross-sectioning and preliminary and final estimates of earth work.

The liberal time scheduled, coupled with the fact that our winters are usually mild and open, allows very thorough instruction in the field and admits class instruction and the field work devoted to the same subject, to occur practically at the same time.

In field practice the class is divided into groups, so as to allow the maximum amount of practice to each individual. The members of the groups alternate as to duties, so that each one in turn has ample opportunity for mastering every detail.

The instruments above noted are of the best makes. Among them may be mentioned, Buff & Berger, Heller & Brightley, W. & L. E. Gurley, Keufel & Esser and Young & Son.

Additions are constantly being made, keeping pace with the growth of the school.

Many students, in the vacation between their Junior and Senior years, have secured employment at underground or surface surveying in various mining "camps."

DRAUGHTING.

PROF. CURTIS. ASST. PROF. HAZARD. MR. HALDANE.

It is the object of this department to first give a thorough grounding in all the more elementary parts of Mechanical Drawing, and to follow this with their application in the most practical way possible in a technical school.

SOPHOMORE DRAFTING ROOM

The student is first taught the proper way of using his instruments, preparing his sheets, etc., and then given the simplest of geometrical figures, to cultivate some skill in their use. At this time individual instruction is given each student.

The work then leads into the more difficult elements of drawing, including line shading and tinting, together with lettering, and no student is allowed to proceed who can not neatly execute at least two alphabets in free-hand.

Then follows the more difficult work in connection with the subject of Descriptive Geometry, including a large number of elementary problems, leading gradually into the advanced work of that subject, and ending with problems in shades and shadows and isometric projections. This completes the purely elementary work.

In this work, as in the more advanced, no grades are given. Each drawing must reach a certain standard, such as would hold in any well regulated drawing office, before being accepted, and under these conditions all drawings are of the same rank, except as to artistic effect, which is not a requisite of pure Mechanical Drawing.

The advanced drawing is all of practical nature. The elements which have been mastered in the previous years are here combined, and only the methods used in the best American drawing offices are followed.

To this end, the drawing rooms have been equipped with the most efficient appliances. The Freshmen have large, rigid drawing tables, with ample room for each individual, and the advanced classes have improved individual tables, adjustable in every way, the light being reflected from the perfectly white walls, giving a mild diffused light, much preferred to strong direct light.

The blue-print room is complete in every way, and students are taught to make prints either from tracings, or direct from the bond papers now so much used.

Applicants for advanced standing must bring with them the work they have executed in Mechanical Drawing, or in Descriptive Geometry.

The work by years is as follows:

FRESHMAN YEAR.

The work of the first term includes the use of drawing instruments, mounting sheets, etc. The proper selection of instruments, testing and care of pen points, and like details, all of great importance to the beginner. Plain geometrical problems, simple projections and intersections; plans, elevations and sections, exercises in lettering, both free-hand and with the instruments; line shading, tinting and shading with tints; with applications of each as in working drawings. The working of problems, as given in Church's Descriptive Geometry, including a large number of exercises relating to the first seventeen problems as there given. In the second term problems in intersections, including the intersections of planes with cylinders, planes and cones, planes and surfaces of revolution, surfaces of revolution with surfaces of revolution, etc.; exercises in shades and shadows, and isometric projections, occupy the whole time.

SOPHOMORE YEAR.

At the beginning of this year the study of Elementary Mechanism is taken up in the class-room and continues throughout the year.

The whole of the first term is occupied with problems involving the continual use of the principles of Descriptive Geometry in the representation of actual machine parts.

The rest of the year is given over to problems in Mechanism. This includes the laying out of lobed wheels, spur wheels, beveled wheels, sprocket wheels, cams, special motions with link work, etc.

Blue printing is explained at the beginning of the year, and the student becomes practiced in the process by making prints of his own work from time to time.

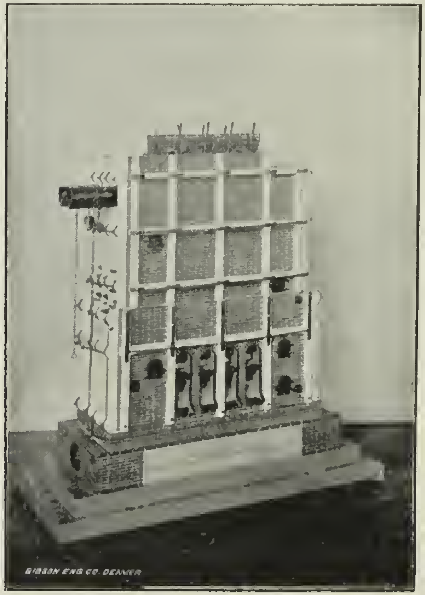
Special pains are taken all through this year to get the student in the way of making good working drawings according to the best American practices.

JUNIOR YEAR.

The study of Machine Design is taken up in the class-room at the beginning of this year and continues through the year. The drawing is all in connection with this study, and includes the designing of such parts of machines as follows: Bolts and nuts; keys and cotters; pipes and pipe joints; shafting and shaft couplings; journals and journal bearings; arms, hubs and rims of gear wheels, belt wheels, sheave wheels, etc. Rivets and riveted joints; belts and gearing, brackets and pillow blocks, with other devices, are all explained and drawn.

SENIOR YEAR.

The Draughting of this year is distributed among the several departments of Metallurgy, Engineering and Electrics. Designs assigned according to the special work of the student, are executed of metallurgical plants, masonry work and bridges, and of electrical machinery. The draughting of this year, in short, is not intended as instruction in draughting, but as applied work.



LIBRARY.

The Library contains nearly five thousand volumes (exclusive of pamphlets), mostly scientific and technical works, though history, travels and other works of a miscellaneous character have not been neglected.

A careful inventory of the library, made in November, 1901, gives a valuation of $12,200, exclusive of pamphlets.

Complete sets of the transactions of the institute of mining engineers, civil engineers, association of engineering societies, journals of chemistry, electricity and metallurgy, and technical cyclopedias in various lines, are among the recent additions.

Students are allowed the use of the library and may borrow books under the usual restrictions. A portion of the library is set aside as a reading space.

The authorities of the institution desire to acknowledge the generosity of Capt. E. L. Berthoud, of Golden, and of Mr. Edw. G. Stoiber, of Silverton, in presenting a number of valuable works.

INVENTORY AND VALUATION.

The valuation of buildings (land included) is slightly over one hundred and fifty thousand dollars.

The inventory for 1901 gives permanent apparatus at $21,000, minerals and other specimens in the collection at $14,000, furniture and fixtures at $22,000.

The apparatus in the various departments can hardly be named here in detail. Reference should be made to the headings "Departments of Instruction," under which some description will be found.

BUILDINGS AND GROUNDS.

(1). BUILDING OF 1880-'82.

The combined building of 1880-'82, has the main dimensions of 100x70 feet, two stories, and basement extending under most of the space.

The Riehle testing machine (see "Mechanics"), stands in the south basement, which contains besides, rooms for testing material and for the storage of laboratory supplies.

The main floor is wholly occupied by chemical laboratories, balance rooms, and rooms for the storage and issne of apparatus. (See "Chemistry.")

The second floor contains the main lecture room for mathematics. The lecture room for general chemistry is next in order, with annex room for apparatus.

Special laboratories (50x25) are also upon this floor, the remainder of whose space is occupied by several small rooms for balances and apparatus of various kinds.

(2). BUILDING OF 1890.

The length of this building is one hundred feet; its width from fifty-seven to sixty-eight feet. Its basement contains the gymnasium (q. v.) lavatories, shower bath, work-shop, steam-heating, boiler and gas apparatus.

The first floor contains the offices of the Faculty, Registrar, library and reading room, and the department of geology and mineralogy. The latter is divided into two rooms, one for the museum, one for working department and lecture room.

The second floor is divided into: (1.) Lecture room for metallurgy, containing also the collections and models for this department. (2.) Lecture room for mathematics, chiefly devoted to Freshman work. (3.) Lecture room for engineering classes. (4.) Lecture room, used by various classes. (5.) Office rooms for Professors.

The third floor is occupied by the Freshman Draughting room (four thousand square feet). This fine room is lighted largely by skylights, and is fitted up with conveniences for stretching and washing drawings, and other appliances. It accommodates over one hundred and twenty students.

This building stands upon ground overlooking the town, and presents a handsome appearance. It was first occupied at the opening of the fall term of 1890.

(3). BUILDING OF 1894 (HALL OF ENGINEERING).

Engineering Hall is a three-story brick and stone structure, fifty by seventy-five feet. The lower floors are devoted to Physics and Electricity, the upper floor contains two large draughting rooms, a blue-print room, and Professor's office.

The second floor is devoted to Physics and to elementary work in Electricity and Magnetism. The lecture room, furnished with raised seats, will accommodate seventy students. For experiments in light, the room can be quickly darkened. The photometer room is fitted for experiments in light and the measurement of arc and incandescent lamps. The room devoted to laboratory work in Physics and Elementary Electrical Measurements, is well lighted and fitted with slate shelves and heavy tables. Gas, air, water and electricity are supplied at various points in the laboratory.

The south half of the lower floor is divided into two rooms, the larger containing the fifty horse-power, high-speed engine, the dynamos and motors for testing purposes. All wires run from this room to the smaller, which contains the slate switch board, the measuring instruments for testing work, and the large resistance coil. A small workshop connects with the dynamo room. The battery room, floored with tiles, contains the sixty-cell accumulator and various primary batteries. Three light rooms furnished with piers, on the north side of the building, are devoted to advanced work in Electrical Measurements. Little iron is used in the construction of the lower portion of the building, so that all the rooms are well adapted for electrical measurements.

The boiler house contains the Sturtevant engine and fan, eighty horse-power boiler, feed pumps, heater, etc.

R. S. Roeschlaub, of Denver, was the architect of the buildings of 1890 and of 1894.

The total floor space in the three buildings is over forty-five thousand square feet.

(4). BUILDING FOR FIRE ASSAYING.

This building is described under its proper heading, page 39.

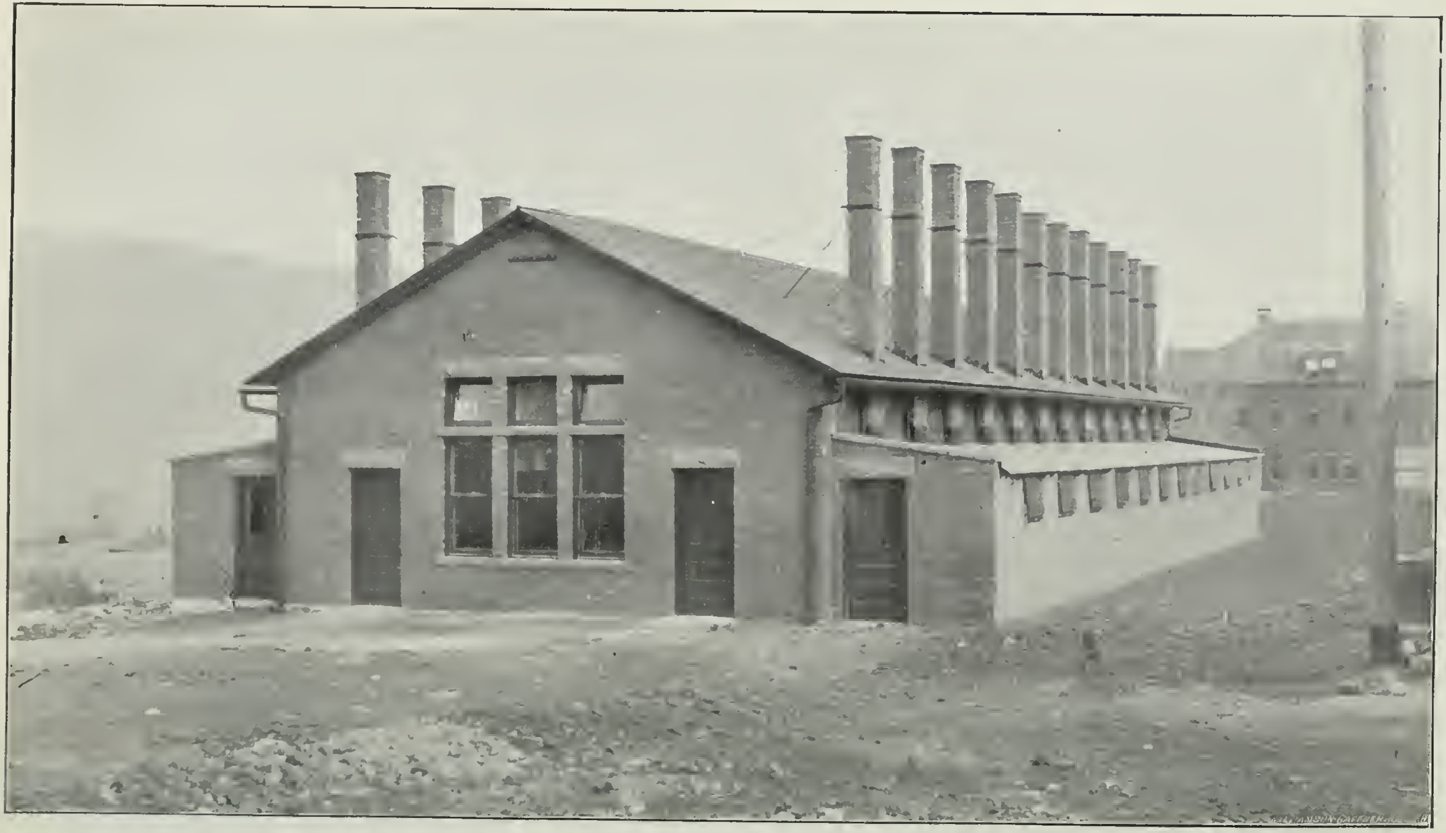
(5). GROUNDS.

The tenth General Assembly gave $5,000 for improvement of the grounds, the City of Golden permitting the absorption of the street formerly dividing Engineering Hall from the other buildings. Stone walks, terraces and grass plats now give to the entire premises a finish long lacking.

A final readjustment of the space in the buildings of 1880, 1882 and 1890, effected in the fall of 1900, allows the utilization of all the space hitherto unavailable.

The site, well above the main part of the town, is admirable, both for scenic and sanitary environment.

Recent purchases of land (1899, 1901) in the immediate vicinity of the present grounds affords space for future expansion, a necessity already indicated by the rapid rise in numbers.



ASSAY LABORATORY. 1900.

THE COLLEGE YOUNG MEN'S CHRISTIAN ASSOCIATION.

This association occupies several pleasant centrally located rooms, where the best magazines are kept on file, and where the students may drop in any afternoon or evening, to chat or play games. Here a religious meeting is held every Sunday afternoon, to which all college men are welcome. Speakers from outside the association occasionally address these meetings, which have proven to be very helpful occasions.

The social instinct is not neglected, and the frequent receptions tendered to their friends by members of the society have been both successful and entertaining.

The association makes it a part of its duty to secure accommodations for new comers, and seeks also to make them feel at home during the first few weeks of their entering term, the most trying period of a student's life. The success along this line has been quite flattering.

The association also distributes among the students a handbook of useful information, at the beginning of the first term.

The great need of such an organization has long been recognized, and its influence has already shown good results.

The Corresponding Secretary for 1902 will be A. C. Terrill ('95). He will gladly answer any inquiries concerning expenses or general student life.

OFFICERS.

F. A. Thomson ('03)------President.
T. P. Liddell ('03)--------Vice-President.
G. M. Butler ('02)--------Corresponding Secretary.
H. M. Parks ('03)--------Treasurer.
T. D. Prier ('04)---------Secretary.

THE ENGINEERING SOCIETY.

In connection with the School is the organization known as the "Technical and Engineering Society," whose active members are drawn from the Senior and Junior classes, the Faculty and Alumni. Sophomores and Freshmen are associate members. Officers are elected from the Senior class.

The object of the society is to promote a feeling of professional fellowship among its members, causing them to regard themselves as already in a measure members of the active technical world.

With this object in view, papers on technical or scientific subjects are presented, both by student and graduate members. It is believed that the writing and delivery of papers forms a very valuable aid to the student in his final preparation for "taking the field."

Connected with the society and contributing in no small degree to its success, is the semi-annual publication entitled the "Bulletin," whose contributors have not been confined to the Faculty and Alumni, but have included men in similar lines of practice in other localities.

Meetings of the society are held monthly in the school building. The officers of the society and of the "Bulletin" are given herewith:

OFFICERS OF THE SOCIETY.

President	Oliver Powers.
Vice-President	C. O. Moss.
Secretary	W. H. Coghill.
Treasurer	G. K. Taggart.

OFFICERS OF BULLETIN.

Chief Editor	L. W. Storm.
Associate Editors	J. W. Bucher. A. H. Collbran. W. A. Funk. G. B. Robinson.
Business Manager	A. C. Watts.
Assistant Manager	W. D. Kilbourn.

ALUMNI ASSOCIATION.

The Association of the Alumni of the Colorado School of Mines holds its annual meeting and banquet on the day following the commencement exercises, unless otherwise provided by the executive committee.

All graduates holding degrees are eligible to membership, and are invited to the annual meeting and banquet.

The aim of the Association is to promote acquaintance and friendship among the graduates, to encourage them to aid each other, and to make an organized effort to elevate and uphold the reputation and standard of the Alma Mater.

All graduates are earnestly requested to join the organized body, and to keep the Secretary advised as to their addresses.

The officers of the Association for the year ending June 20th, 1902, are as follows:

President ____________ Edward P. Arthur, Jr., ('95).
1st Vice President ______ Thos. G. Smith ('99).
2nd Vice President _____ C. M. Warnecke ('97).
Secretary and Treasurer _ Robert S. Stockton ('95).
Executive Committee ___ O. B. Suhr ('95).
Chas. J. Adami ('99).
Robert Nye ('97).

DIRECTORY OF GRADUATES.

NAME AND ADDRESS.	OCCUPATION.
1883.	
Middleton, Wm. B. Denver, Colorado.	Mining Engineer.
Wiley, Walter H. Denver, Colorado.	Mining Engineer.
1886.	
van Diest, Edmund C. San Luis, Costilla County, Colorado.	Superintendent, Costilla Land Grant.
Gehrmann, Charles A. Idaho Springs, Colorado.	Superintendent, Consolidated Stanley Mining Company.
1888.	
Ambrosius, Carl E. Guanacevi, Durango, Mexico.	Mining Engineer.
*Floyd, John A.	
*Kingman, Jerry	
*Lorah, Bela I.	
1889.	
Bellam, Henry L. Anaconda, Montana.	Chemist, Anaconda Mining Company.
Craigue, Wm. H. Colorado Springs, Colorado.	Mining Engineer.
*Wertheim-Salomonson, F.M.G.A.	
1890.	
Comstock, Chas. W. Denver, Colorado.	Professor of Mining Engineering, Colorado School of Mines.

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* Deceased.

NAME AND ADDRESS.	OCCUPATION.
1891.	
Johnston, Edward W. Leadville, Colorado.	Assistant Supt. Arkansas Valley Smelter.
Smith, Charles D. Atacama, Peru, S. A.	Metallurgist.
1892.	
Aller, Frank B. Peru, S. A.	Metallurgist, with M. Guggenheim.
Brown, Norton H. Denver, Colorado.	Surveyor General's office.
Budrow, Wm. B. Antofagasta, Chili.	Supt. Establecimiento de Playa Blanca.
Cole, Burt Los Angeles, California.	Engineer.
Hindry, Willis E. El Oro, Mexico.	Superintendent, Esperanza Mine.
Kimball, George K., Jr. Idaho Springs, Colorado.	Supt. Old Town Mine.
Kimball, Jos. S. Denver, Colorado.	
Lewis, Wm. B. Denver, Colorado.	Manager, Denver Sulphite Fibre Co.
McMahon, Charles H. Sombrerete, Zacatecas, Mexico.	General Supt., Sombrerete Mining Co.
1893.	
Collins, Philip M. Black Hawk, Colorado.	Assayer, Chamberlain Sampling Works.
Hawley, R. Howard Monterey, Mexico.	Chemist, National Mex. Smelting Co.
Jewell, Gilbert E. Chartres Towers, Queensland, Australia.	Metallurgist.
Milliken, Wm. B. Deadwood, South Dakota.	Mining Engineer.
Osborne, Arthur H. Victor, Colorado.	Surveyor.
Stephens, Wallace A. Denver, Colorado.	Metallurgist.

1894.

NAME AND ADDRESS.	OCCUPATION.
Atkins, Horace H. Denver, Colorado.	Am. S. & R. Co.
Bowie, James W. Gallup, New Mexico.	Mine Superintendent, Caledonia Coal Co.
Post, George M. Denver, Colorado.	Asst. Attorney General.
Saint Dizier, Julius L. San Luis Potosi, Mexico.	Engineer, Compañia Metalurgica Mexicana.
Schneider, George W. Central City, Colorado.	Surveyor.
Wheeler, Charles E. Victor, Colorado.	

1895.

NAME AND ADDRESS.	OCCUPATION.
Arthur, Edward P. Cripple Creek, Colorado.	Mining Engineer & U. S. Dep. Min. Surveyor.
Davis, Carl R. Rossland, B. C.	Supt. War Eagle and Center Star M. Co.
Dockery, Love Atkins Matachic, Chihuahua, Mexico.	Mine Supt., Cia. Minera de Penoles.
Durell, Charles T. Maiden, Montana.	Supt. Spotted Horse Mine.
Eaton, Albert L. Leadville, Colorado.	Assayer, Penn M. & L. Company.
Eye, Clyde M. Granite, Montana.	Engineer, Granite Bi-Metallic M. Co.
Field, Fred M. Pony, Montana.	Metallurgist (Cyanide).
Gray, Latimer D. Rock Springs, Wyoming.	Manager, Electric Dept U. P. Coal Co.
Hartzell, Lester J. Phillipsburg, Montana.	Chemist, Granite and Bimetallic Min. Cos.
Kennedy, George A. Silverton, Colorado.	Asst. Gen. Man. Iowa G. M. & M. Co.
Limbach, Edmund C. Denver, Colorado.	Assayer.

1895.

NAME AND ADDRESS.	OCCUPATION.
Maxwell, Fred A. G. Johannesburg, South Africa.	Metallurgist.
Merryman, Herbert E. Cripple Creek, Colorado.	Surveyor.
Parker, James H. New York, N. Y.	Student, Columbia University.
Rowe, Edward E. Denver, Colorado.	Manufacturer, E. E. Rowe & Co., Pressed Brick.
*Shetler, Waverly	
Skinner, Lewis B. Colorado City, Colorado.	Chemist, Colo.-Phila. Reduction Company.
Stannard, Burt C. Everett, Washington.	Chemist, Puget Sound Reduction Company.
Stockton, Robert S. Golden, Colorado.	Professor of Mathematics and Surveying Colorado School of Mines.
Suhr, Otto B. Norris, Montana.	General Supt., Telluride Power Trans. Co.
Titsworth, Frederick S. Denver, Colorado.	Engineer, 207 Boston Building.
Wallace, Lewis R. Morenci, Arizona.	Detroit Copper Co.
Young, Frank B. Denver, Colorado.	Engineer.

1896.

Atkinson, Walter J. Chicago, Illinois.	Civil Engineer.
Barensheer, Wm. J. Argentine, Kansas.	Assayer, Consolidated K. C. S. & R. Co.
Barnes, Corrin Cripple Creek. Colorado.	Assayer and Surveyor, Benjamin & Barnes.
Beeler, Henry C. Cheyenne, Wyoming.	Wyoming State Geologist.

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* Deceased.

1896.

NAME AND ADDRESS.	OCCUPATION.
Dwelle, Jesse E. Denver, Colorado.	Chemist.
Griswold, George G. Denver, Colorado.	Chemist, Globe Smelter.
Hoyt, George F. Mapimi, Durango, Mexico.	Asst. Supt. Smelter Minera de Peñoles.
Maynard, Rea E. Honolulu, Hawaiian Islands.	
Mitchell, George B. Washington, D. C.	Surveyor, Isthmian Canal Commission.
Milliken, John T. Deadwood, South Dakota.	Imp. M. & M. Co.
Nance, Wm. H. St. Louis, Missouri.	St. Louis Smelting & Refining Company.
Newman, Wm. E. Omaha, Nebraska.	Chemist, Am. S. & R. Co.
Paul, Wm. H. Central City, Colorado.	Supt. Mammoth Mine.
Strout, Fred McL. Cripple Creek, Colorado.	Assayer and Chemist.

1897.

NAME AND ADDRESS.	OCCUPATION.
Buck, Arthur H. Mapimi, Durango, Mexico.	Mine Surveyor, Cia Minera de Peñoles.
Bussey, Edwin E. Denver, Colorado.	
Canning, Herbert A. Aspen, Colorado.	Mining Engineer.
Cohen, Louis Sombrerete, Zacatecas, Mexico.	Assayer, Sombrerete M. Co.
Draper, Marshall D. Central City, Colorado.	Supt., Notaway Mine.
Febles, John C. Pueblo, Colorado.	Chemist, Colorado Smelter.
Gross, John Sombrerete, Zacatecas, Mexico.	Supt., Mills of Sombrerete M. Co.
Hazard, W. J. Golden, Colorado.	Asst. Professor in Physics and Draughting, Colorado School of Mines.

1897.

NAME AND ADDRESS.	OCCUPATION.
Jarvis, R. P. New York, N. Y.	Student, Columbia University.
Kelley, W. A. Denver, Colorado.	Chemist, McArthur-Forest Co.
Lerchen, F. H. Scranton, Pennsylvania.	Principal, Metal Mining Division International Correspondence Schools.
Logue, N. W. Leadville, Colorado.	Assayer, Ibex Mining Company.
McLeod, J. Norman Central City, Colorado.	Cyclops Assay Office.
MacGregor, George H. Golden, Colorado.	Student, State School of Mines.
Nelson, H. E. Spokane, Washington.	Engineer for Bradley Engine & Mach. Co.
Nye, Robert Centreville, Idaho.	Engineer.
Powell, George F. Santa Isabel, Chihuahua, Mexico.	Supt., Magistral Mine.
Roller, Arthur H. Idaho Springs, Colorado.	Supt., Idaho Springs M. & Red. Co.
Schumann, Enrique A. New York, N. Y.	
Starbird, H. B. Victor, California.	Supt., Rose M. & M. Co.
Warnecke, Carl M. Sherman, California.	Electrician, Los Angeles & P. Ry. Co.
Weed, Floyd Denver, Colorado.	Chemist, The G. & S. Extraction Co. of America, Ltd.
Woods, Thomas H. Ouray, Colorado.	Supt., Camp Bird Mills

1898.

NAME AND ADDRESS.	OCCUPATION.
Barbour, Percy P. Idaho Springs, Colorado.	Stevens & Barbour, Surveyors.
Bertschy, Perry H. Gilt Edge, Montana.	Chemist, Great Northern M. & D. Co.

1898.

NAME AND ADDRESS.	OCCUPATION.
Blumenthal, Emil E. Phillipsburg, Montana.	Chemist, Granite & Bimetallic Mining Co.
Caldwell, Florence H. Leadville, Colorado.	
Church, Myron J. Ahuacatlan, Tepic, Mexico.	Manager, Two Republics Gold Min. Co.
Clark, Winfred N. Victor, Colorado.	Elec. Engineer, Pike's Peak Power Co.
Corry, Arthur V. Butte, Montana.	Manager, Mont d'Or Mine.
Davey, Wm. R. Lake City, Colorado.	Assayer.
Dollison, James E. Alma, Colorado.	Assayer.
Hamilton, Frank R. Ouray, Colorado.	Assayer, Camp Bird Mine.
Harrington, Orville Denver, Colorado.	
Ingols, J. August Crestone, Colorado.	Surveyor.
Johnston, Fred Leadville, Colorado.	Chemist, A. V. Smelter.
Jones, Frank H. Leadville, Colorado.	Assayer and Surveyor.
Kræmer, Edw. L. Smelter, Montana.	Assayer, Am. Smelt. & Refining Co.
Lampe, Oscar A. Parral, Mexico.	Assayer.
Lucy, Richard W. Pueblo, Colorado.	Office of Division Engineer D. & R. G. R.R.
Magenau, William Frederickstown, Missouri.	Supt., Catherine Lead Co.
Norman, John Edw. San Luis Potosi, Mexico.	Chemist.
Rodriguez, J. Crisostomo Saltillo, Mexico.	Mine Superintendent.
Smith, Harry C. Central America.	
Stephens, Charles N Denver, Colorado.	Surveyor General's Office.

1898.

NAME AND ADDRESS.	OCCUPATION.
Valentine, Malvern R. Parral, Chihuahua, Mexico.	Engineer, Parral Milling Co.
Whitaker, Orvil R. Pony, Montana.	Engineer, Juannette G. M. Co.

1899.

NAME AND ADDRESS.	OCCUPATION.
Adami, Charles J. Butte, Montana.	Engineer, Anaconda M. Co.
Bruce, Stuart S. Leadville, Colorado.	Eng., Const. Dept. Arkansas Val. Smelter.
Cramer, Curtis P. Fierro, New Mexico.	Gilchrist & Dawson Co.
Davis, Gilbert L. Leadville, Colorado.	Asst. Mgr., Iron Silver Mine.
Grant, Lester S. Cripple Creek, Colorado.	Surveyor, Isabella Gold M. Co.
Hodgson, Arthur Denver, Colorado.	Assayer, Denver Mint.
Johnson, Gilbert Ouray, Colorado.	Assayer and Surveyor, Amer. Nettie Mine.
Kelley, Fred G. Black Hawk, Colorado.	Surveyor, Bost. & Denver Con. M. & M. Co.
Muir, David Ydalpom, Shasta County, California.	Asst. Supt., Bully Hill Mine.
Rising, Arthur F. Perth Amboy, New Jersey.	Asst. Chemist, Raritan Refining Co.
Royer, Frank W. Denver, Colorado.	Engineer.
Smith, Thos. G. Denver, Colorado.	Asst. Supt., Grant Plant, Am. S. & R. Co.
Steinhauer, Frederick C. Denver, Colorado.	Asst. Engineer, Eastern Div. C. F. & I. Co.
Thompson, James S. Denver, Colorado.	Asst. Engineer, Western Div. C. F. & I. Co.
Townsend, Arthur R. Guayaquil, Ecuador.	Assayer, South Am. Development Co.
Tyler, Sydney B. Panuco de Coronado, Durango, Mex.	Engineer, San Luis M. Co.

1899.

NAME AND ADDRESS.	OCCUPATION.
Waltman, Will D. Colorado Springs, Colorado.	Asst. City Engineer.
Weiss, Andrew Golden, Colorado.	Asst. Professor in Mathematics and Surveying, Colo. School of Mines.
Williams, Wakely A. Grand Forks, British Columbia.	Asst. Supt., Granby Cons. M. & M. Co.
1900.	
Adams, Wilber E. Lewiston, Idaho.	Mining Engineer & U. S. Dep. Min. Surveyor.
Benwell, George A. Pueblo, Colorado.	Surveyor, C. F. & I. Co.
Bruce, Harry F. Pueblo, Colorado.	Office of Division Engineer, D. & R. G. R.R.
Crowe. Thomas B. Cripple Creek, Colorado.	Asst. Mgr., Gold Exploration Co.
Drescher, Frank M. Pueblo, Colorado.	Surveyor, C. F. & I. Co.
Evans, Henry R. Virginia City, Nevada.	Assayer.
Ewing, Charles R. Bingham, Utah.	Supt., York and Red Wing Mine.
Giddings, Donald S. Morenci, Arizona.	Asst. Surveyor, Detroit Copper M. Co.
Harrington, Daniel Sunnyside, Utah.	Surveyor, Pleasant Valley Coal Co.
Jones, Edward B. Denver, Colorado.	Mgr., The National Development Co.
Jones, Fred Cripple Creek, Colorado.	Surveyor. John A. Logan Mine.
Lemke, Carl Del Norte, Colorado.	
Malmstrom, C. Clarence Cripple Creek, Colorado.	Surveyor.

1900.

NAME AND ADDRESS.	OCCUPATION.
Moynahan, Ambrose E. Alma, Colorado.	Assayer and Surveyor.
Nicolson, George W. Silverton, Colorado.	The Contention M. Co.
Pendery, John M. Leadville, Colorado.	
Platt, Edwin H. Denver, Colorado.	Engineer, Denver Eng. Works.
Price, Lyttleton, Jr. Boise, Idaho.	Surveyor General's Office.
Prout, John Fredericktown, St. Francis County, Mo.	Columbia Lead Co.
Robey, Lloyd Telluride, Colorado.	Surveyor, Liberty Bell Mine.
Rudd, Arthur H. Jamestown, Boulder County, Colorado.	Surveyor.
Slater, Amos Denver, Colorado.	C. F. & I. Co.
*Smith, Claude H.	
Steele, James H. Park City, Utah.	Silver King Mine.
Taylor, Harry Picotte Hailey, Idaho.	Consulting Engineer, Rosetta M. Co.
Utley, Howard Harris Louisville, Kentucky.	Engineer, North Jellico Coal Co.

1901.

NAME AND ADDRESS.	OCCUPATION.
Atwater, Maxwell W. Telluride, Colorado.	Liberty Bell G. M. Co.
Bishop, Raymond Ouray, Colorado.	Camp Bird Mine.
Bowman, Frank C. Hill City, South Dakota.	Supt., Golden Summit Mine.
Bradley, Joseph M. Florence, Colorado.	Assayer.

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* Deceased.

1901.

NAME AND ADDRESS.	OCCUPATION.
Breed, Charles Francis Salt Lake City, Utah.	Smith & Lyon, Civil and Mining Engineers.
Brinker, Arthur C. Ouray, Colorado.	Camp Bird Mine.
Bruce, James L. Cripple Creek, Colorado.	Surveyor for Hills & Willis.
Bumsted, Edward J. Guayaquil, Ecuador.	Assayer, South Am. Development Co.
Burlingame, Walter E. Denver, Colorado.	Assayer for E. E. Burlingame.
Chandler, John Winthrop, Jr. Salt Lake City, Utah.	
Clark, George B. Segundo, Las Animas Co., Colorado.	Surveyor, C. F. & I. Co.
Collins, Shrive B. Creede, Colorado.	Surveyor.
Crow, Wade L. Maiden, Montana.	Spotted Horse Mine.
De Cou, Ralph E. Creede, Colorado.	Assayer.
Downer, Roger H. Ouray, Colorado.	Camp Bird Mine.
Ehle, Mark, Jr. Rapid City, South Dakota.	Professor of Mining, Dakota School of Mines.
Frank, Harry L. Burke, Shoshone Co., Idaho.	Hecla Mine.
Harris, Willard F. Ouray, Colorado.	Camp Bird Mine.
Jackson, Walter H. Telluride, Colorado.	Contention Mine.
Johnson, Junius W. Georgetown, Colorado.	Surveyor.
Lewis, Frank E. Great Falls, Montana.	Assayer, B. & M. C. C. & S. M. Co.

1901.

NAME AND ADDRESS.	OCCUPATION.
Lovering, Ira G. Denver, Colorado.	
Lucy, Frank Allen Idaho Springs, Colorado.	Surveyor.
McDaniel, Alexander K. Butte, Montana.	Eng. Dept. Butte & Montana Co.
Marrs, George Oliver	
May, John G. Velardena, Durango, Mexico.	The Velardeña M. & M. Co.
Millard, Frank W. Telluride, Colorado.	Smuggler-Union Mine.
Parrish, Carl C. Denver, Colorado	Engineer.
Pray, Winfred A. Santa Rita, New Mexico.	Surveyor.
Sale, Andrew J. Denver, Colorado.	
Scheble, Max C. Stella, Shasta County, California.	Supt., Bullychoop M. Co.
Simpson, William P. Monterey, Mexico.	Assayer, La Gran Fundicion.
Small, Harvey B. Ojuela, Mapimi, Durango, Mexico.	Surveyor.
Starbird, Edwin P. Victor, California.	Rose M. & M. Co.
Street, Gerald B. Salt Lake City, Utah.	Engineer.
Watson, Hugh C. Leadville, Colorado.	Engineer.
Williams, Fred Tuttle Cripple Creek, Colorado.	Assayer, Stratton's Mines.

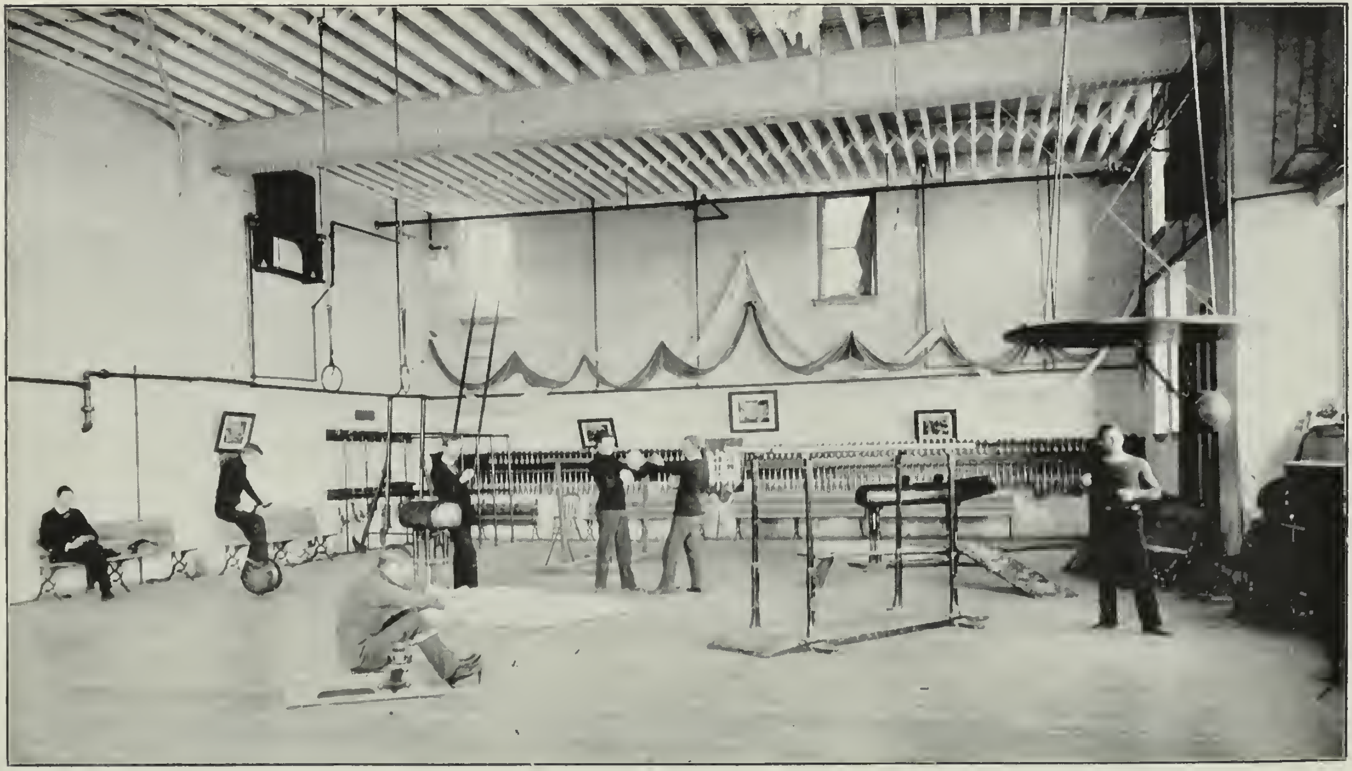
Alumni will confer a favor by notifying Prof. Stockton of errors or omissions in the above catalogue, which is known to be incomplete as to residences and occupations.

GYMNASIUM.

The Gymnasium is the most spacious and the best equipped of any college or school gymnasium in the State, and is a valuable adjunct to the school equipment. It is in the basement of the building of 1890, its floor (65x40) admitting drill exercise, with ample space for apparatus, while its height of twenty feet allows the use of swinging appliances and perfect ventilation. Around the walls are pulling weights of every description, while among the other instruments are swinging rings, parallel bars, horse buck, quarter circle, "cage" with apparatus for development of every set of muscles, ladders, spring board, complete sets of clubs and dumb-bells and many others.

The Gymnasium is open every school afternoon, also for systematic class work and "free exercise" three evenings of each week. Instruction is given in gymnastic exercises on those evenings. Shower baths (hot or cold) adjoin the gymnasium. Each student pays a fee of five dollars a year, to the Athletic Association and deposits one dollar for his locker key.

The Gymnasium is managed by the "School of Mines Athletic Association," composed of officers and students of the institution. The Directors of this Association are responsible to the school for the maintenance of order and care of apparatus.



GYMNASIUM.

TEXT BOOKS.

Richter's Inorganic Chemistry.
Medicus' Qualitative Analysis.
Cairns' Quantitative Analysis.
Furman's Manual of Assaying.
Wentworth's Higher Algebra.
Crawley's Trigonometry.
Tanner and Allen's Analytical Geometry.
Osborne's Calculus.
Stahl and Wood's Elementary Mechanism.
Low and Bevis' Machine Drawing and Design.
Grant's Gear Wheels.
Church's Descriptive Geometry.
Morris' Geometrical Drawing.
Carhart's University Physics.
Stewart and Gee's Practical Physics.
Ames and Bliss' Manual of Experiments.
Balfour Stewart's Principles of Heat.
Bell's Electric Power Transmission.
Hutton's Mechanical Engineering of Power Plants.
Johnson's Surveying.
Nagle's Field Manual.
Merriman's Hydraulics.
Ziwet's Theoretical Mechanics.
Bovey's Theory of Structures.
Schnabel's Metallurgy.
Le Conte's Geology.
Kemp's Handbook of Rocks.
Moses and Parsons' Mineralogy, Crystallography and Blow-Pipe Analysis.
Patton's Lecture Notes on Crystallography.

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LIBRARY

LOGUE

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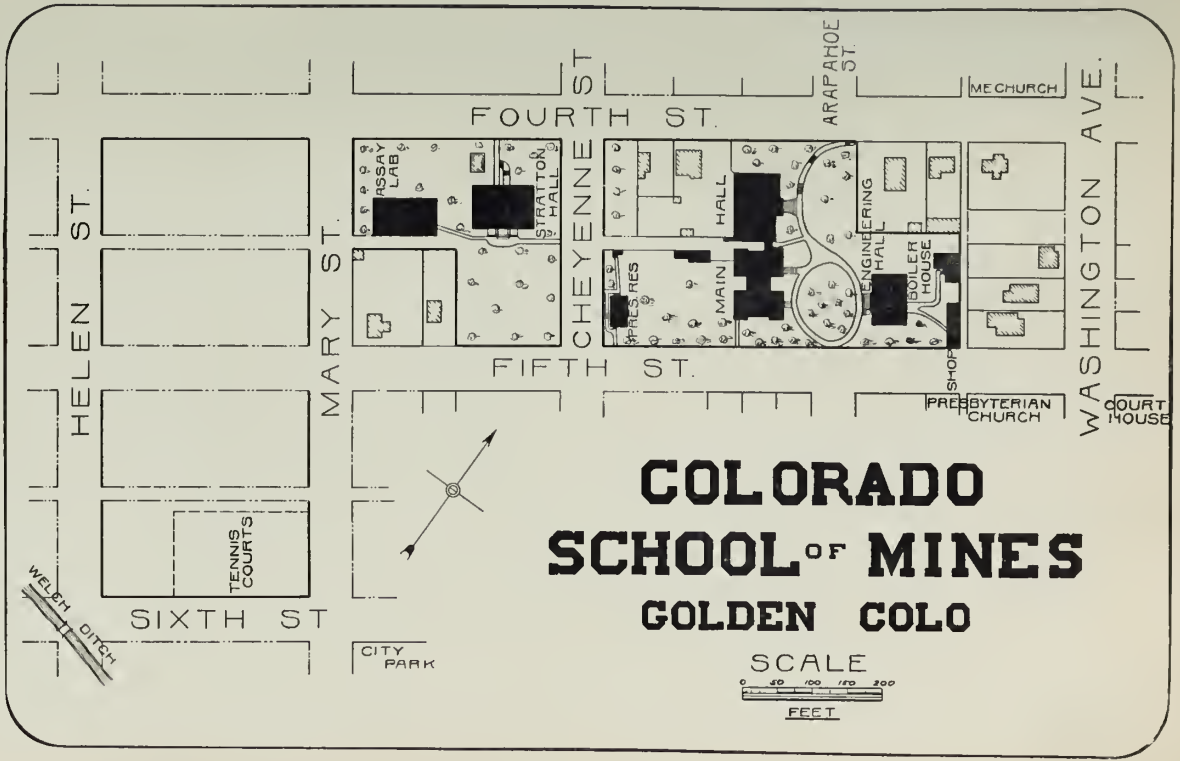
COLORADO SCHOOL OF MINES
GOLDEN COLO
SCALE
0 50 100 150 200
FEET
FOURTH ST.
FIFTH ST.
SIXTH ST
HELEN ST.
MARY ST.
CHEYENNE ST
ARAPAHOE ST.
WASHINGTON AVE.
ME CHURCH
PRESBYTERIAN CHURCH
COURT HOUSE
ASSAY LAB
STRATTON HALL
HALL
MAIN
PRES. RES
ENGINEERING HALL
BOILER HOUSE
SHOP
TENNIS COURTS
CITY PARK
WELCH DITCH

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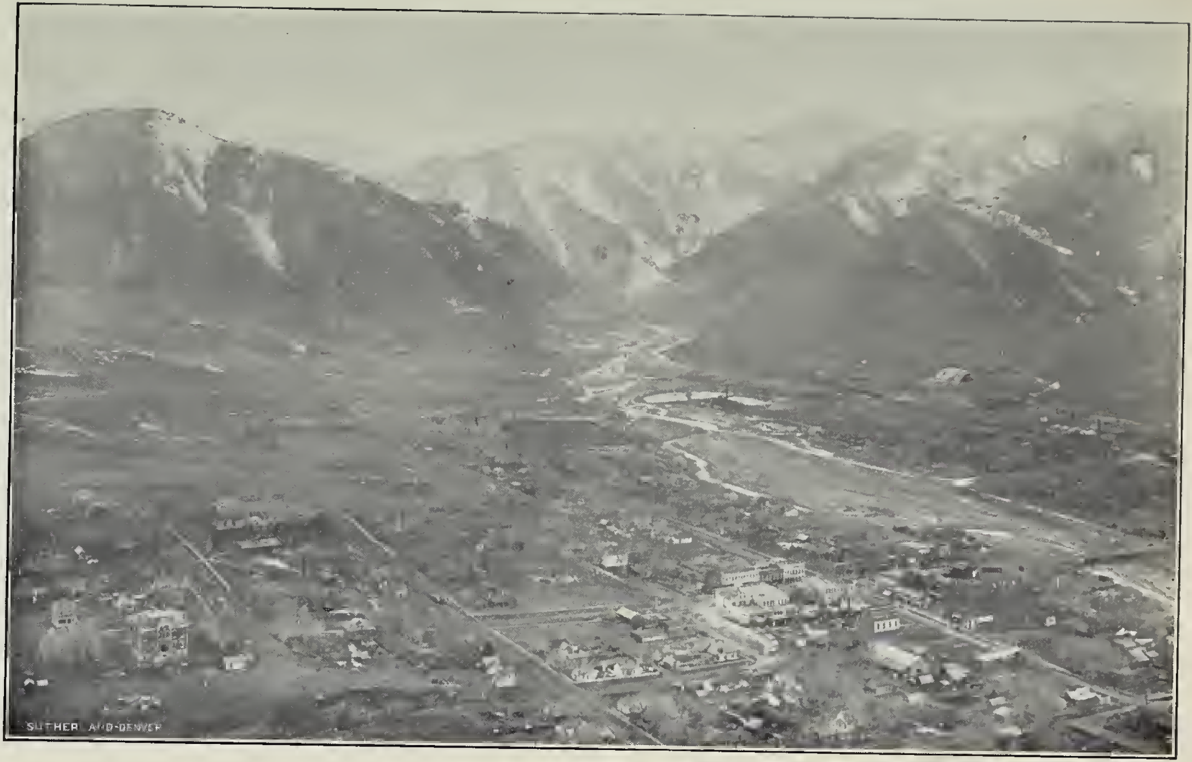

SCHOOL OF MINES

GOLDEN AND CLEAR CREEK CANON LOOKING WEST FROM CASTLE ROCK.

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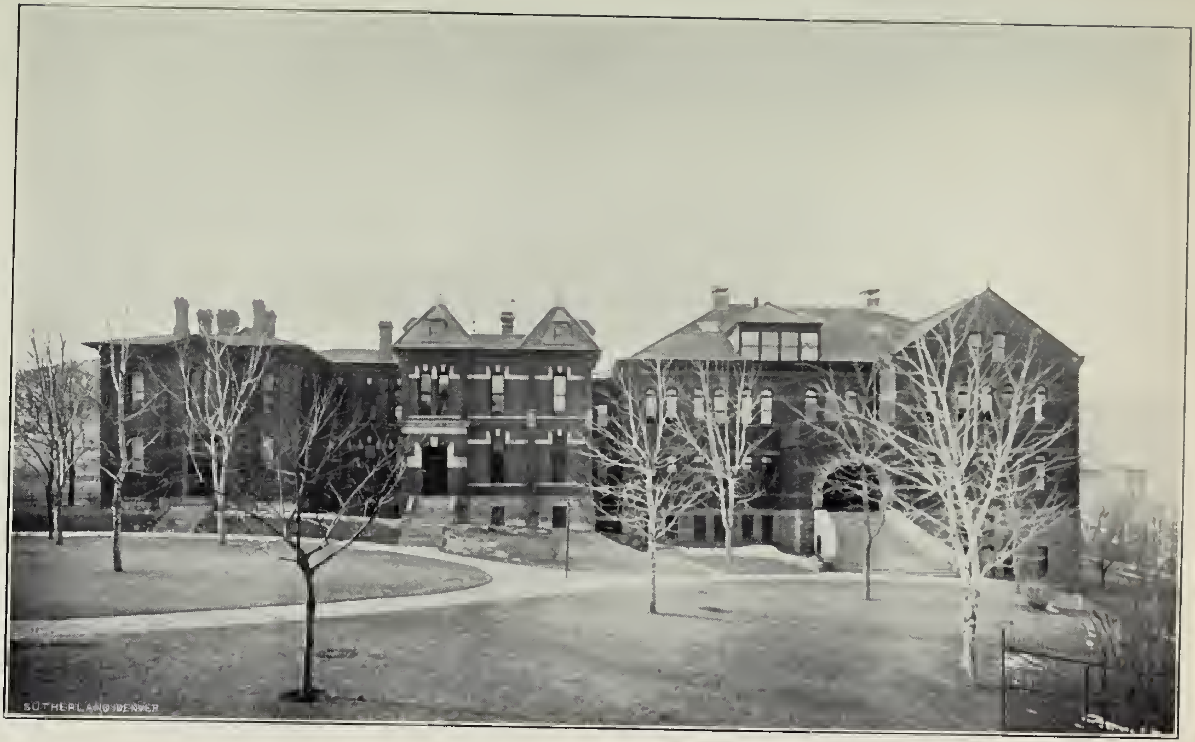

1880. 1882. 1890.

EAST FRONT MAIN BUILDING.

THE
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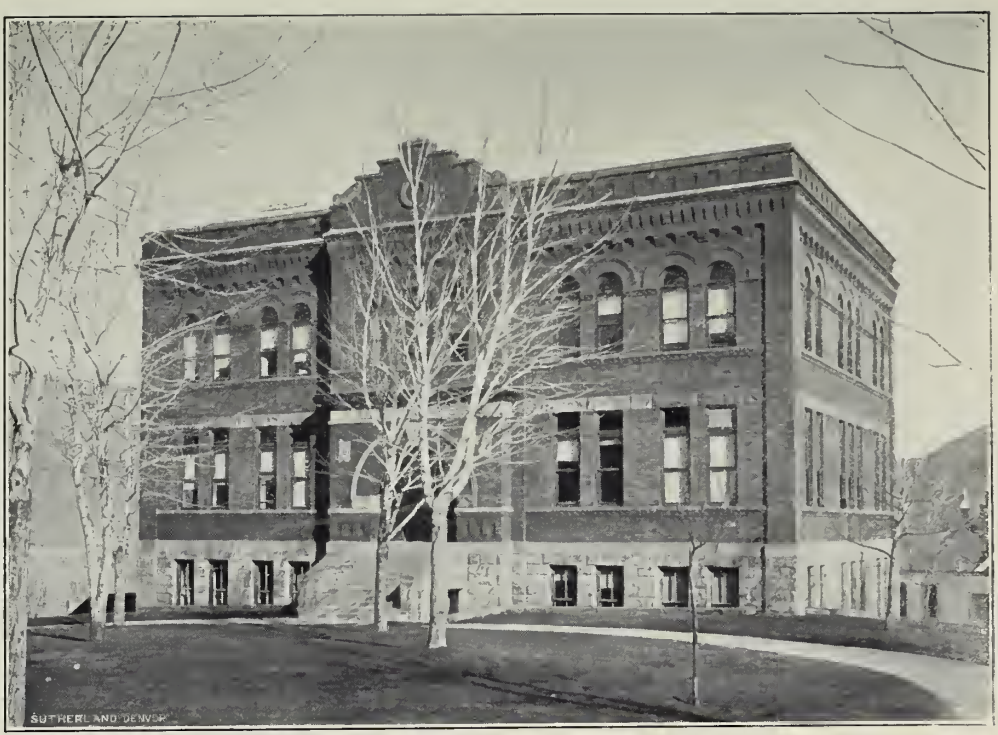

WEST FRONT, HALL OF ENGINEERING.

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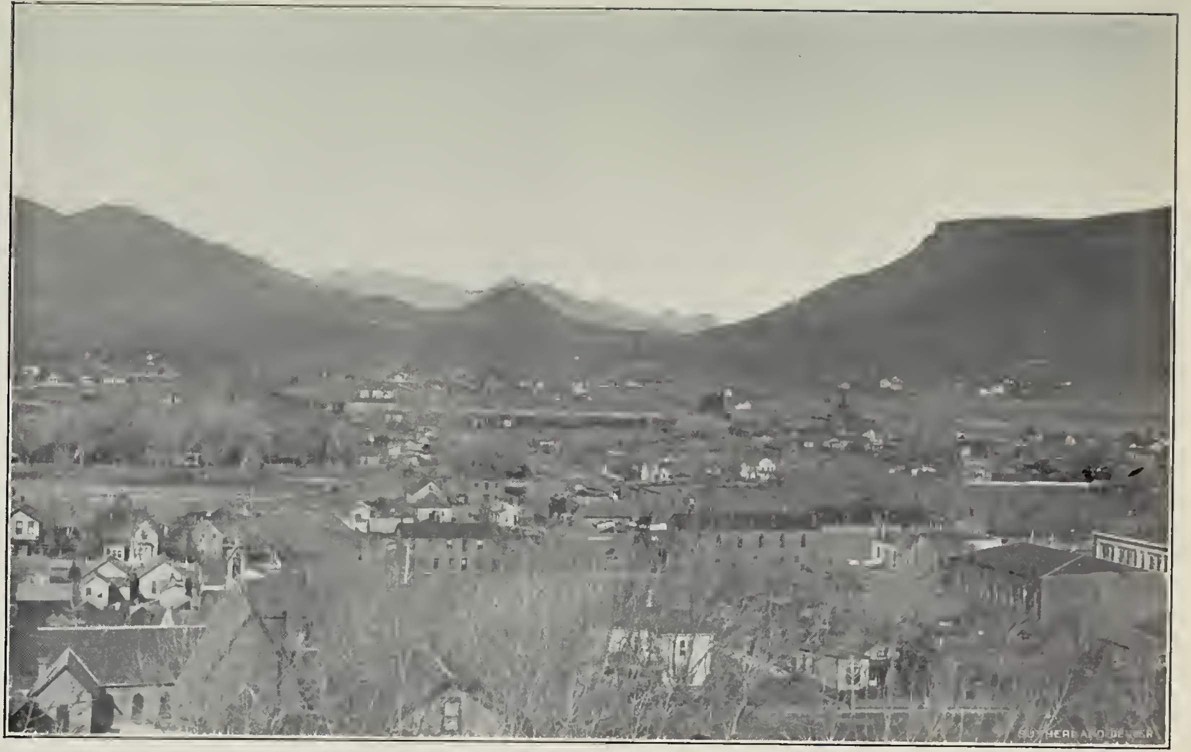

LOOKING NORTH FROM THE SCHOOL OF MINES.

THE
JOHN CRERAR
LIBRARY.

LABORATORY OF ASSAYING.

THE
JOHN CRERAR
LIBRARY.

ANNUAL CATALOGUE

OF THE

COLORADO SCHOOL
OF
MINES.

GOLDEN, COLORADO.
1902-1903.

c. 2

W. F. ROBINSON PTG. CO.
DENVER.

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CALENDAR—1902, 1903, 1904.

1902

JULY

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SCHOOL CALENDAR.

1902.

June 19	Graduation of the class of 1902.
Sept. 10	Beginning of entrance examinations.
Sept. 15	First semester begins.
Nov. 20	Laying of the corner stone of Stratton Hall.
Nov. 27	Thanksgiving recess begins.
Dec. 20	Christmas vacation begins.

1903.

Jan. 5, 10 a. m.	Christmas vacation closes.
Jan. 22	Close of recitations of the first semester.
Jan. 23	Beginning of examinations of the first semester.
Feb. 2	Beginning of second semester.
Feb. 22	Washington's Birthday. (No holiday, it being on Sunday.)
April 17	Arbor Day.
May 15	Senior trip begins.
May 15	Close of recitations of the second semester.
May 18	Beginning of examinations of the second semester.
May 21	First examination for admission to the class of 1907.
May 22	Close of examinations of the second semester.
May 24	Baccalaureate Sunday.
May 25-27	Commencement exercises.
Sept. 9	Second examination for admission to the class of 1907.
Sept. 10	Re-examinations of matriculated students.
Sept. 14	Opening of the first semester of the academic year 1903-1904.
Nov. 26	Thanksgiving recess begins.
Dec. 19	Christmas vacation begins.

1904.

Jan. 3	Christmas vacation closes.
Jan. 22	First semester ends.
Jan. 25	Second semester begins.

BOARD OF TRUSTEES
OF THE COLORADO SCHOOL OF MINES.

EDWARD L. BERTHOUD, C. E.	Golden, Colo.	Term expires 1903
FRANK BULKLEY, E. M.	Denver, Colo.	Term expires 1903
W. S. MONTGOMERY	Colo. Springs, Colo.	Term expires 1903
JAMES T. SMITH	Denver, Colo.	Term expires 1905
OTTO F. THUM	Denver, Colo.	Term expires 1905

OFFICERS OF THE BOARD OF TRUSTEES.

MR. FRANK BULKLEY	President
MR. JAMES T. SMITH	Secretary

The regular meetings of the Board are held in Golden, at the School of Mines, on the second Thursday of each month.

NEW MEMBERS OF THE BOARD.

JAMES F. CONE	Canon City, Colo.	Term expires 1907
JOSEPH S. JAFFA, LL. B.	Denver, Colo.	Term expires 1907
JOHN P. KELLY, Ph. C., M. D.	Golden, Colo.	Term expires 1907

FACULTY.

CHARLES S~~KEELE PALMER, Ph. D.~~ V. C. Alderson
President.

PAUL MEYER, Ph. D.
Professor Emeritus of Mathematics.

LOUIS CLARENCE HILL, B. S., (C. E.), (E. E.)
Professor of Physics and Electrical Engineering.

HORACE BUSHNELL PATTON, Ph. D.
Professor of Geology and Mineralogy.

ARTHUR RANSLEY CURTIS, B. S.
Professor of Machine Design and Drafting.

ROBERT SUMMERS STOCKTON, E. M.
Professor of Mathematics and Acting Professor of Mining.

CARLTON RAYMOND ROSE, A. M.
Professor of Assaying (and acting Professor of Metallurgy till Feb. 1903).

ROBERT NELSON HARTMAN, Ph. D.
Professor of Chemistry.

CLAUDE W. L. FILKINS, M. C. E.
Professor of Mechanics.

WILLIAM GEORGE KING, A. M.
Professor of Metallurgy.

WILLIAM JONATHAN HAZARD, E. E.
Assistant Professor in Physics and Descriptive Geometry.

ANDREW WEISS, E. M.
Assistant Professor in Mathematics and Surveying.

CHARLES DARWIN TEST, B. M. E., A. C.
Instructor in Analytical Chemistry.

WILLIAM GEORGE HALDANE, B. S.
Instructor in Mathematics and Drafting.

JULIUS WOOSTER EGGLESTON, A. M.
Instructor in Mineralogy.

EUGENE WILSON GEBHARDT, B. S.
Instructor in Mathematics and Drafting.

HERMAN CLAUDE BERRY, A. B., B. S.
Instructor in Mathematics and Surveying.

MABEL CLAIRE SHRUM, B. L. S.
Librarian.

GEORGE P. ROBINSON,
Library Assistant.

BENJAMIN ATL~~AS AMBLER~~, J. C. Doolittle
Registrar.

COMMITTEES OF THE FACULTY.

COMMITTEE ON ADMISSION AND STANDING,
Professors Hill, Stockton, Hazard.
COMMITTEE ON THE CATALOGUE,
Professors Hill, Hartman, Filkins.
COMMITTEE ON BUILDINGS AND GROUNDS,
Professors Curtis, Hill, Filkins.
COMMITTEE ON THE LIBRARY,
Professors Rose, Curtis; Miss Shrum.
COMMITTEE ON ATHLETICS,
Professors Patton, Hartman; Messrs. Haldane, Test.
COMMITTEE ON THESES,
Professors Filkins, Rose.
COMMITTEE ON GRADUATE WORK,
Professors Hartman, Filkins, Curtis.
COMMITTEE ON THE BULLETIN,
Professors Stockton, Filkins.
COMMITTEE ON THE Y. M. C. A.,
Professor Hazard; Mr. Eggleston.
COMMITTEE ON SOCIAL AFFAIRS,
President Palmer.

LOCATION, HISTORY, ORGANIZATION, ETC.

Location. The Colorado School of Mines is in the south-central part of the city of Golden, Jefferson County. Golden is about fifteen miles from Denver, and can be reached either by the Colorado & Southern R. R. from the Union station at the foot of Seventeenth Street, or by the Denver, Lakewood & Golden R. R., from the Arapahoe Street station between Fourteenth and Fifteenth Streets. From the necessities of the work all students reside in Golden.

Golden has about three thousand inhabitants and is one of the oldest cities in Colorado. When the Colorado School of Mines was located at Golden, the city was one of the most important smelting centers of the State, and its selection as a permanent home for the School was both natural and appropriate. Subsequently the business and the population of Golden suffered by the removal of the smelters and their concentration at Denver; but recently the little city has awakened to a new birth of activity and anticipation, due to its certain development into a residence town such as usually clusters around a college—which promise is strengthened by the fact that Golden is the most available mountain or foot-hill home suburban to and available from Denver.

Golden has one bank, many churches, a fine public school system, two newspapers (weekly), several elevators, and other lines of business, including a smelter, brick works, etc., and altogether is a thriving, prosperous, growing city, an ideal home for a great school of mines. The peculiar grouping of the neighboring hills is such as to combine the practical and the picturesque—freedom and isolation.

The School owns about four blocks, as shown in the map accompanying this catalogue.

The altitude of Golden is five thousand seven hundred feet above sea level, or about four hundred and fifty feet higher than Denver.

The town lies close to the first foot-hills of the Rocky Mountains, but can hardly be considered as a "mountain town," though within an hour's ride, by rail, of some of the well-known mining camps of the region.

No place in Colorado has a better health record than Golden. The climate is invigorating and pleasant, with open winters, and a large proportion of clear days.

The surrounding region is rich in the characteristic scenery of the Rocky Mountain region. The famous Clear Creek Canon begins at the town of Golden, and within a few miles may be found many points of view which the railroad tourist travels to see imperfectly from the car window.

Probably no locality in the United States could be found richer in geological illustrations of the formations of various ages, affording abundant opportunity for practical instruction, as well as exercise.

History. The Colorado School of Mines was established by an act of the Territorial Legislature, approved February 9, 1874. After an unsatisfactory experience in shifting in temporary quarters, the School was permanently housed in the original "building of 1880," upon lots given by the citizens of Golden. Since then the School has enjoyed a strong and steady growth in buildings, in equipment, in students and faculty, and in strength and rigor of the course. Additions were made to the original building of 1880, by the building of 1882 and the building of 1890. Engineering Hall was erected in 1894, the Stratton Assaying building in 1900, and the new hall of engineering called Stratton Hall is now in process of completion.

The list of faithful, able and scholarly men, who have contributed to the growth and reputation of the School in the past, is a long one, and among them may be counted President Gregory Board, President Albert C. Hale, President Regis Chauvenet; but it is to the latter that the Commonwealth is chiefly indebted for his ambition, determination, and patience in raising the standard of the School so that her present prosperous state may be regarded as his handiwork.

Organization. The corporate name of the institution by statute is "The School of Mines." The general management of the Colorado School of Mines is vested by statute in a Board of Trustees, consisting of five members appointed by the Governor of the State with the advice and consent of the Senate.

The members of the Board of Trustees are appointed in alternating sets of two and three, and hold their office for a period of four years and until their successors are appointed and qualified. The Board of Trustees elect one of their number President of the said Board. They also appoint a Secretary and Treasurer either from their own number, or they may select other suitable persons as they may deem best. Any three of said Board of Trustees shall constitute a quorum for the transaction of business.

The president of the faculty of the School, who shall be appointed by the said Board of Trustees, shall be known as "President of the School of Mines."

By the organic Constitution of Colorado, the School of Mines is regarded as an Institution of the State.

Financial Support. The Colorado School of Mines is supported by the income derived from the annual tax of one-fifth (1-5) of a mill on each dollar of the assessed property of the State, and this is known as the "School of Mines Tax." In addition to this the legislature has, from time to time, provided by special appropriation for such emergency funds as the means of the State treasury and the necessities of the School might suggest.

Of the two hundred and fifty thousand dollars now represented by buildings and equipment—as shown by the last inventory—only about fifty-seven thousand has been given by special appropriation; about twenty-six thousand has been received as gifts, and the balance, about a hundred and sixty-seven thousand, has been saved from the general revenue by strict economy.

GENERAL MEETINGS.

Weekly Assembly. A new departure in the school life is the weekly assembly of all students in the gymnasium. The programme, which opens at 10:10 on Monday morning, includes general notices, music, and an address by some member of the faculty, each in his turn, or by some distinguished guest; or the morning hour may be given over wholly or in part to a student athletic rally or the like. The meetings are of value in bringing together all members of the school, both students and faculty. In a technical school the human side of man is liable to be neglected, and these gatherings are coming to be counted as one of the most valuable, most necessary, and most natural of the various assemblies.

The Scientific Society. This organization includes all the members of the senior and junior classes. Fortnightly meetings are held at which technical papers are read. The official publication of the society is the "Bulletin," a high class journal of papers prepared by the faculty, the alumni, and the seniors. Two numbers of the Bulletin will be published this year.

Spanish. An optional class in Spanish has been conducted by a student, Mr. Paredes.

The College Y. M. C. A. There is in the School an active branch of the Young Men's Christian Association. The Association has rooms in which are held religious meetings and social gatherings. A class in Bible study is conducted throughout the year. An effort is made to receive and assist incoming students to whom also a reception is given at the opening of the school year. A hand-book of school information is issued by the Association and can be obtained on application to the corresponding secretary, Max W. Ball, Golden, Colorado.

BUILDINGS.

The Main Building. This is a continuous group of brick structures including the building of 1880 and that of 1882, as well as that of 1890. The first two are practically thrown together, and with one large and one small laboratory, two private laboratories, the stock room, two balance rooms and two lecture rooms, accommodate chiefly chemistry and some of the mathematics. In the cellar of the building of 1882 is placed the Riehlé testing machine, some cyanide apparatus and much of the surplus geological material; the ground under the original building of 1880 is not excavated. The more recent and more modern part, the building of 1890, has two full stories in addition to the attic and the basement. In the body of the first floor are located the President's office, the Registrar's office, the library, and the geological cabinet and lecture room. On the second floor are placed the temporary lecture rooms in Metallurgy, and the several lecture rooms for Mathematics and Mechanics, as well as two private offices for the same. The attic is devoted to the Freshman drafting room, and the basement to the temporary heating plant, the gymnasium lockers, the bath rooms, and the gymnasium, which is now the only available assembly room.

The total floor space of the buildings of 1880, 1882 and 1890 is forty thousand square feet.

Hall of Engineering. This building, consisting of two floors and a basement, and constructed of red pressed brick, was completed in the fall of 1894. The upper floor contains the Junior and Sophomore drafting rooms, a blue print room and a private office. The physics lecture room and apparatus room, a photometer room, the physical laboratory, balance room and apparatus room, as well as a private office, occupy the first floor.

The basement contains the dynamo and the engine room, three electrical laboratories, a battery and switch-board room and a small shop. The floor space is eleven thousand square feet.

Assay Building. This building, completed in the fall of 1900, is devoted entirely to assaying. It is a brick structure, forty-six feet by ninety-two, without cellar, and is well equipped with balance, store and parting rooms, as well as an office. There are at present thirty-two large muffle furnaces, each with its work desk and coal bin; there is room for sixteen more furnaces.

This structure, which is one of the most perfect of its kind in the world, was erected by a gift from the late W. S. Stratton.

Stratton Hall. This structure, the corner stone of which was laid by the A. F. & A. M. of Colorado, on November 20, 1902, will be ready for occupancy at the beginning of the next academic year. The dedication will probably constitute part of the Commencement exercises in June, 1903. The building is to be of two full stories, not including the basement and attic. The basement wall and first story are to be of Lyons sandstone, in broken ashlar, topped by a story of gray Golden brick. The building will be finished on the interior with red pressed brick; and but little wood will be used, beyond that in the floors and staircases. The basement will accommodate several rooms for metallurgical and cement laboratories. The first floor will be devoted to two large lecture rooms, each with apparatus and private office—for Metallurgy and Mechanics. The second floor will, in one half, accommodate Surveying and Mining in one large lecture room, with its apparatus room and private office, and in the other half, a drafting room. The attic floor will be devoted entirely to a large drafting room.

The completion of the building will greatly relieve the present congested state of the departments of Mathematics, Surveying, Mechanics, Metallurgy, and Mining.

The total floor space of this building is twenty thousand feet.

The structure was named in honor of the late W. S. Stratton, whose generosity has won the lasting gratitude of the School.

The President's House. This is a brick building of two and one-half stories. It was built in 1888, and was quite thoroughly overhauled in 1902.

The Wood Shop. This is well equipped for the special demands which are continually arising around a technical school. This work varies from the ordinary repair work on the one hand, to the careful construction of special apparatus on the other.

The Iron Shop. What has been said of the wood shop is equally true of the iron shop. There is no machine shop of any kind in Golden, and so it is imperative that the school have one of its own in order to keep its mechanical apparatus in proper repair and working order, as well as to construct such apparatus as is necessary to carry on any new or original work. The machines of both shops are driven by direct connected motors, thus giving a very good idea of this method of operating machines of all kinds. Both shops are fully equipped with the necessary benches and hand tools. They occupy a building sixteen by fifty feet in addition to the store room for lumber, etc. The shops have proven to be not only a great convenience, but also a means of economy.

Boiler House. This building contains an eighty horse power fire-tube boiler, the Sturtevant fan and engine for heating Engineering Hall, and the necessary receiving tanks, feed pumps, etc., of a power plant.

EQUIPMENT.

Physical Laboratory.

This department is fairly well supplied with demonstration apparatus, and the equipment of the laboratories is excellent for the courses given. A full line of micrometers, vernier calipers, scales of all kinds, Jolly balances, physical and analytical balances, accurate Boyle's-law apparatus, Kater's pendulum, inclined planes, pulleys, etc., these and much other material furnish a good equipment for the laboratory course in Mechanics. For measurements in light, this department is furnished with a Bunsen photometer and a Lummer-Brodhun photometer, with lenses, mirrors and prisms for illustrating and verifying the various laws of reflection and refraction. Hypsometers, numerous thermometers of all grades, including standard and Beckman thermometers, calorimeters, latent-heat-of-steam apparatus, both the ordinary and the Parr's coal calorimeter, electrical apparatus for the determination of the mechanical equivalent of heat, apparatus for the measurement of the expansion of metals, etc., these and many other pieces furnish the equipment for the work in heat.

The laboratories for work in elementary electricity and magnetism are well equipped with good modern apparatus. The list comprises five British-Association bridges, three Wheatstone bridges, a revolving bridge, standard resistances and resistance boxes, five D'Arsonval galvanometers, two Thompson galvanometers, electrolytic apparatus, etc. For the more advanced work in this subject there are Weston, Whitney and Thompson direct-reading instruments, three Siemen's dynamometers, a dynamometer wattmeter, a Kelvin balance, condenser standard cells, permeaters, etc.

Chemical Laboratory.

The laboratories, lecture rooms, and equipment of the department of Chemistry occupy almost all of the space of the buildings of 1880-1882, and on the completion of the Stratton Hall of Metallurgy, now under construction, still more space will be available, and it is the intention of the School to use this at once for additional laboratories, principally for special work.

The main laboratory is situated on the first floor of the buildings mentioned which have been thrown together for the purpose. It is equipped with tile-topped oak desks, especially designed, which are fitted with gas, water, and filtering apparatus. The laboratory will accommodate one hundred and two students at one time. The desks are so constructed, however, that it is possible to have twice this number in two sections. There is ample light and ventilation, and the numerous effective hoods are connected with a large Sturtevant blower, which discharges from a high brick stack. The hoods are also fitted with gas attachments, and a number are fitted with connections for hydrogen sulphide gas which is generated in the basement. A three muffle fusion-and-assay furnace is part of the equipment. There are on this floor in connection with the main laboratory, the issue room for supplies, two private laboratories, and a balance room.

On the second floor of the building of 1880 is a large laboratory, accommodating fifty-five students, which is fitted with gas, sinks, and hoods. This is used mainly for the commercial analytical work. There is also an office and a balance room in connection with this department. The Chemical lecture room is on the second floor of the building of 1882, and is the largest lecture room in the school, having a seating capacity of about one hundred and twenty. It is fitted with a desk adapted for experimentation and has an apparatus room attached.

In the basement of the buildings are the chemical and apparatus supply rooms, which connect with the issuing room by elevator; also a special laboratory, used mainly for thesis work, the gas machine room which contains the hydrogen sulphide apparatus, and a three-hundred-light Detroit Gas machine, with mixer.

In addition to the usual supply of apparatus and chemicals used for general analysis, the department possesses a fair supply of pieces of apparatus designed for use in the more advanced courses. This includes electrolytic apparatus, combustion furnaces, gas analysis apparatus, spectroscopes, and numerous other supplies for special work.

Mineralogical and Geological Laboratory and Cabinet.

Under the name cabinet is embraced not only the distinctively display collections which may perhaps be called the cabinet proper, but also the other collections that have been prepared mainly for the purpose of class instruction. These collections are necessarily changing rapidly from year to year as new material is constantly being added. This new material is obtained partly by purchase but mainly by direct collecting and by means of exchange with other institutions.

Owing to the rather limited quarters assigned to this department the display collections are not classified systematically but are arranged in different cases with a view to displaying certain groups of minerals or minerals from certain localities. The display collections are to be found in flat glass-topped cases and the other collections in cases of drawers.

Among the more interesting displays are quartz and microcline crystals from Florissant, Colo.; golden calcites from Joplin, Mo.; fluorite and barite from England; epidote crystals from Alaska; pyroxene, epidote and magnetite crystals from Salida, Colo.; sphalerite crystals from Kokomo, Colo.; pyrite crystals from Gilpin County, Colo.; crystallized sulphur from Sicily; dolomite and calcite from Ouray County, Colo.; geyserite from the Yellowstone National Park; and, above all, several cases of zeolites (thomsonite, mesolite, analcite, chabazite, etc.), from North Table Mountain, Golden, Colo. The case of mesolites is unique as well as beautiful, as it cannot be duplicated by any cabinet in the world.

The various collections are classified as follows:

First—A Mineral Type Collection, consisting of well-characterized specimens to be used by the students for the purpose of study and comparison. This collection at present contains specimens representing two hundred and seventeen species and sixty-one additional varieties. These specimens come from many countries, but Colorado minerals are especially well represented.

Second—A Display Collection, mainly of large and fine specimens of minerals and rocks. Many graduates and mining men, friends of the institution, have contributed gifts to this collection.

Third—A Supplementary Collection, containing the rarer and more expensive minerals not placed in one of the above mentioned collections.

Fourth—A Descriptive Collection, illlustrative of the terms used in describing the various structural, physical, optical, and other properties of minerals.

Fifth—A Student's Working Collection of Minerals, consisting of over twenty thousand unlabeled specimens, similar to those in the Type Collection, to be used by the student for study and determination.

Sixth—A Crystal Collection, consisting of natural crystals to be used in the determination of crystal forms.

Seventh—A Crystal Model Collection, containing a large number of glass and wooden models used in the study of Crystallography.

Eighth—A Blow-Pipe Collection, containing materials used in Blow-Piping.

Ninth—Rock Type Collection, containing (a) a collection of rocks from different countries of the world; (b) a series of Colorado rocks; (c) various rocks illustrative of structural features.

Tenth—A Working Rock Collection, containing miscellaneous unlabeled rocks, to be used by students in connection with the study of Lithology.

Eleventh—A Collection of Fossils, to be used in connection with the course in Historical Geology.

Twelfth—The United States Geological Survey "educational series" of rocks.

Thirteenth—Professor Patton's private collection of minerals.

Fourteenth—Professor Patton's private collection of rocks.

Summary of Collections.

Type Collection of Minerals	3,700
Working Collection of Minerals (about)	21,000
Display Collection of Minerals	1,305
Supplementary Collection of Minerals	950
Crystal Collection	1,800
Display Collection of Fossils	342
Miscellaneous Collection of Fossils	1,360
Type Collection of Rocks	1,800
Working Collection of Rocks	7,408
United States Geological Survey Educational Series of Rocks	156
Professor Patton's Collection of Rocks	1,700
Professor Patton's Collection of Minerals	970
Summary of specimens	42,491

Owing to the constant growth of the Cabinet, many recent additions are not included in this summary.

Exchanges.

The School has prepared a printed list of exchange material, covering both minerals and rocks. This list will be sent to all who wish to arrange for exchanges. Correspondents should state what material they are prepared to offer in exchange, and letters should be addressed to Prof. H. B. Patton, Golden, Colo.

Drawing Rooms.

Freshman. This occupies the whole of the top floor of the main building. The floor area is about four thousand square feet. It is lighted by windows on the north, east, and west, and by eight large skylights in the roof.

A suitable office for the instructors is located in a central position in which all drawings are filed and all records kept. Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The present equipment will accommodate about one hundred and fifty students.

Sophomore-Junior. The removal of the Senior drawing to Stratton Hall will make available ample space for the Sophomore drawing, which at present is very much cramped for room. Thus the whole of the top floor of Engineering Hall will then be used for the Sophomore and Junior drawing in connection with the subject of Mechanism and Machine Design. (The Junior drawing in connection with surveying and graphics will be done in Stratton Hall). The two rooms in the Hall of Engineering to be used for the drawing proper are each twenty-seven by fifty feet. They are lighted by windows on three sides and by skylights.

Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The tables are independent of each other and are adjustable. The present equipment will accommodate about seventy-five students.

There is a blue print room fully equipped with an adjustable printing frame, and all other necessary appliances; also an office for the instructor where all drawings and records are filed.

Senior. This work until the present has been carried on in the north half of the upper floor of the Hall of Engineering; but after the completion of Stratton Hall, most of the upper floor will be devoted to the Senior drafting.

Surveying Equipment.

The equipment of the department of Surveying is well adapted to the practical course given. Students are organized into parties for field work. Each party is assigned a locker containing steel measuring tapes, marking pins, hatchet, plumb bobs, etc. For transit work there are available six light mountain transits, four of which are provided with auxiliary telescopes for underground work; and all have some form of solar attachment to be used in determining the true meridian, and latitude from the sun.

There is also one six-inch engineer's transit with Saegmueller attachment, and one heavy transit of English make. For the level work, five wye levels are used. For reconnoissance work or stope measurement, the department has a Locke hand level, a pocket compass and clinometer, and a Brunton transit.

The instruments above noted are of standard makes. Among them may be mentioned Buff & Berger, Heller & Brightly, W. & L. E. Gurley, Keufel & Esser, and Young & Son.

Additions are constantly being made, keeping pace with the growth of the school and the wearing out of the instruments.

All instruments belonging to the school are intended solely for use in class instruction and will not be loaned to students or others. This regulation holds during vacation as well as in the school semesters.

Hydraulic Laboratory.

Part of the laboratory work in hydraulics will be given in the new power house where the experiments will be conducted on the flow over weirs, and through orifices and pipes. Experiments on the flow through ditches and flumes will be made on the numerous irrigating canals in Golden. By special arrangement, the experiments on water wheels will be made in the new power house of the Golden Illuminating Company. This will make available a head of nearly twelve hundred feet and a quantity of water during the time when this work is in progress sufficient to generate three hundred to three hundred and fifty horse-power. The long wood-stave pipe line will be available for experiment on the flow in that class of pipe. This line is nearly thirteen miles in length and will be available in long stretches for experimental work.

Steam Laboratory.

The very crowded quarters of the present laboratory are to be exchanged for far more commodious ones in the new power house. There will then be available for testing purposes one compound direct-connected engine, one high speed automatic engine, one fifteen horse-power throttling engine, besides six or seven pumps of various makes. It is expected that a small rotary engine as well as a small steam turbine will soon be added to the equipment. The water tube and fire tube boilers are to be so piped that they may form part of the laboratory equipment. The laboratory is provided with continuous counters, recording counters, indicators, gauges, gauge testers, mercury-column, steam calorimeters, a coal calorimeter, measuring tanks, scales, etc.

Electrical Laboratory.

This laboratory is well equipped with standard voltmeters and ammeters, large resistances, (inductive and non-inductive), motors, dynamos, and storage batteries. Tests are made of the efficiency of the various machines, their characteristic curves are obtained, and their behavior under various loads is noted. A large part of the work of this laboratory is done in connection with that in the steam and hydraulic laboratories, as part of the apparatus will be in the new power plant.

Testing Laboratory—(Mechanics.)

The laboratory is provided with a one hundred thousand pound Riehlé testing machine arranged for experiments in tension, compression, shearing, and flexure of most materials of construction. Extensometers for measuring elongations, and electrical contact micrometer for measuring deflections and compressions are employed. Apparatus for testing columns of small dimensions, and a simplified machine to examine the strength of beams in flexure will soon be ready for use in the laboratory.

In Stratton Hall will be found a complete equipment for examining the quality and strength of cement and cement mortars.

Laboratory of Fire Assaying.

Through the generosity of the late W. S. Stratton, of Colorado Springs, the Board of Trustees has recently completed a building forty-six by ninety-two feet, which is devoted entirely to assaying. This building is well equipped with parting, balance and store rooms and office, and has at present thirty-two coal-fired muffle furnaces, with space for sixteen more. Each student has his own muffle, with his own coal bin, pulp balance and desk room, conveniently arranged with regard to his furnace; he also has access in the balance room to the best assay balances to be obtained on the market. In addition to the use of coal-fired furnaces, the student is instructed in the use of gasoline furnaces, two varieties of which are in the laboratory.

Metallurgical Materials.

1. The School has the advantage of a fine collection of models from the works of Theodore Gersdorf, Freiberg, Saxony, illustrating the best types of furnaces, in this country and Europe. Each model is made to a scale and is complete in every detail. The following furnaces are represented:

Long hearth roasting furnaces, for silver, lead and copper ores.
American lead-silver furnace, as used in Colorado smelters.
Round silver-lead furnace, as used in Germany.
Small round silver-lead furnace, of type used with scant water supply.
Complete "plant" for refining "base bullion," including the following models:
Softening furnace in Parks' process, as used at Pueblo, Kansas City, St. Louis, etc.
Zinc pots as used in same.
Sweating furnaces as used in same.
Lead pots as used in same.
Concentration cupel for making silver bullion.
Belgian zinc furnace, as used in Missouri, New Jersey and Belgium.
Silesian zinc furnace, as used in parts of Europe.

Silver amalgamation pan (working model), as used in United States.

Copper reverbatory furnace, as used in Montana, Colorado, etc.

Gerstenhofer roasting furnace, for fine copper and iron sulphides.

Tin blast furnace, as used in Saxony.

Bismuth smelting furnace, as used in Germany.

Large mercury furnace, as used in Almaden, Spain.

Fume furnace, for making lead and zinc paints.

A handsome addition to these models has come from the liberality of Mr. John W. Nesmith, President of the Colorado Iron Works. It includes:

Working model of twenty-stamp mill, on scale of one and one-half inches to the foot.

Working model of ore rolls, same scale.

Working model of a Dodge crusher.

Model of modern blast furnace for lead-silver ores, with water jacket.

In addition to the above there are a large number of smaller models, such as the complete set used in the famous Keyes and Arents lead-well suit.

2. The School has considerable apparatus in practical demonstration, including jigs, tables, crushers, amalgamating machinery, a cyaniding outfit, etc., and much more is promised as soon as proper space is provided. The immediate expansion of this department will constitute an important feature of the policy of the School.

3. The whole neighboring region with its numerous and varied metallurgical, milling and mining plants, represents an available study laboratory rarely equalled and never surpassed.

Mining Material.

This department is equipped with many mine models, in glass, paper, or metal, and showing all details of geological structure, mechanical working, timbering, lighting, etc. The equipment is being increased constantly, one of the latest gifts being a model of the **Colorado Central Mine** at Georgetown, presented by Mr. Ernest Le Neve Foster. The development of this department comprises some of the most important problems connected with the practical training of a Mining School, and it will undoubtedly claim and assume large attention in the immediate future.

The equipment of the department devoted to mining can be largely increased as soon as space is provided for exhibits of mining machinery, and for experimental work. Many hundred lantern slides are used to show the different methods of mining and timbering, and to illustrate the types of gallows-frames, and machinery used. A number of typical ore deposits are illustrated by a series of thirty-four large maps. These are designed to facilitate the detailed study of the mode of occurrence and probable origin of such ore bodies.

The Gymnasium.

The Gymnasium is a valuable adjunct to the school equipment. It is in the basement of the building of 1890, its floor (sixty-five by forty) permitting drill exercise, with ample space for apparatus, while its height of twenty feet allows the use of swinging appliances and perfect ventilation. Around the walls are pulling weights of every description, while among the other instruments are swinging rings, parallel bars, horse buck, quarter circle, "cage" with apparatus for development of every set of muscles, ladders, spring board, complete sets of clubs and dumb-bells and many other pieces.

The Gymnasium is open every school afternoon and till seven o'clock every evening. Shower baths (hot or cold) adjoin the gymnasium. Each student pays a fee of ten dollars a year to the Athletic Association and deposits one dollar for his locker key.

The gymnasium is managed by the "School of Mines Athletic Association," composed of officers and students of the institution.

The gymnasium is also used for the gatherings on Monday morning and on other public occasions.

ATHLETIC ASSOCIATION.

By virtue of the athletic fee required from each student, all students regularly entering the School of Mines become members of the Athletic Association. The affairs of the association are managed by eight directors elected by the students, two from each class, and by the Faculty Committee on Athletics.

All matters involving expenditure of money are passed upon by both bodies so as to assure economy of management. In most matters the Faculty Committee serves as an advisory committee, the responsibility and initiative being left as far as possible in the hands of the student directors.

The association is supported by the students' fees, by gate receipts, and by contributions from the alumni and other friends of the School. All funds are in the hands of the treasurer who, by resolution of the Board of Trustees, must be one of the Faculty Committee on Athletics.

During the past year the athletic field has been purchased and paid for. It is expected that a permanent grand stand will be erected during the spring of 1903.

Officers.

President of Directors	Harry G. Palsgrove
Secretary of Directors	Frank J. Nagel
Treasurer	Professor H. B. Patton

Directors.

Seniors	Frank J. Nagel, Harry G. Palsgrove
Juniors	Lee L. Fillius, Robert M. Vaughn
Sophomores	Luther W. Lennox, Leroy L. Middlekamp
Freshmen	T. Stephenson, H. D. Whitehouse

THE LIBRARY.

The accumulation of a library suitable for a technical school has been the growth of years, but it was not until January, 1902, that President Chauvenet and the Trustees wisely decided to reduce to a system the gathering and registering of the various materials, by employing a competent librarian, Miss Mabel C. Shrum. The books number six thousand volumes, including the bound files of the standard periodicals, and excluding many hundred unbound pamphlets. While the substance of such a collection of books must always emphasize particularly the technical phase, yet a touch of the human is recognized by including some of the standard histories, travels, and the English classics, as well as some of the more popular journals of the day.

In the long run every scientific library owes its chief value to, and is estimated by, its complete files of standard journals.

The list of the current periodicals is given below.

The following sets of publications in the library are entitled to special mention:

Transactions of the American Institute of Mining Engineers. (1871 to date).

Mineral Industry. (1892 to date).

Journal of the Association of Engineering Societies. (1882 to date).

Transactions and Proceedings of the American Society of Civil Engineers. (1866 to date).

Annual reports of the United States Geological Survey. (1880 to date).

Monographs of the U. S. Geological Survey. (1882 to date).

Bulletins of the U. S. Geological Survey. (1883 to date).

Pennsylvania Geological Survey. (1876 to 1892).

Hayden Geological Survey. (1870 to 1879).

Missouri Geological Survey. (1891 to date).

Powell Geological Survey. (1882 to 1893).

Smithsonian Publications. (1864 to date).

Pacific Railroad Survey. (1853 to 1856).

Transactions of the Federated Institution of Mining engineers (1895 to date.)

Transactions of the Institute of Mining and Metallurgy (1892 to date.)

Report of U. S. Coast and Geodetic Survey. (1865 to date).

Proceedings of the Colorado Scientific Society. (1883 to date).

American Institute of Electrical Engineers. (1888 to date).

Annales des Mines. (1830 to 1882).

U. S. Patent Reports. (1891 to date).

Journal of the Franklin Institute. (1893 to date).

Journal of Society of Chemical Industry (complete).

American Journal of Science. (1871 to date).

Philosophical Magazine. (1890 to date).

American Chemical Journal. (1893 to date).

Journal of American Chemical Society. (1876 to date).

Science (complete).

Electrical World. (1890 to 1898).

Electrical Engineer. (1890 to 1898).

Electrical World and Engineer (complete).

Transactions of American Society of Mechanical Engineers. (1885 to date).

London Electrician. (1890 to date).

Journal of the Iron and Steel Institute, (1883 to date.)

CURRENT PERIODICALS IN THE COLORADO SCHOOL OF MINES LIBRARY.

American Chemical Journal.
American Engineer.
American Geologist.
American Institute of Electrical Engineers.
American Journal of Mathematics.
American Journal of Science.
American Machinist.
Anglo-Colorado Mining and Milling Guide.
Annales de Chimie et de Physique.
Annals of Mathematics.
Architects' and Builders' Magazine.
Astrophysical Journal.
Atlantic Monthly.
Aurum.
Australian Mining Standard.
Ballarat School of Mines Students' Magazine.
Berg und Hüttenmännische Zeitung.
Berichte der Deutschen Chemischen Gesellschaft.
Booklover.
Bookman.
Bulletin de la Société de L'Industrie Minérale.
Bulletin of the Geological Society of America.
Camp and Plant.
Cassier's Magazine.
Century.
Chemical News.
Chemisches Central-blatt.
Collier's Weekly.
Colorado School Journal.
Colorado Scientific Society Proceedings.
Compressed Air.
Comptes Rendus Mensuels des Réunions de la Société de L'Industrie Minérale.
Comtes Rendus des Séances de L'Académie des Sciences.
Cosmopolitan.
Cumulative Index.
Dingler's Polytechnisches Journal.
Electric and Automobile Patents.
Electrical Age.
Electrical World and Engineer.
Electrician.
The Engineer.
Engineering.
Engineering and Mining Journal.
Engineering Magazine.
Engineering News.
Engineering Record.
Fliegende Blätter.
Forum.
Gas Engine.
Le Génie Civil.
Government Publications.
Harper's Monthly.
Harper's Weekly.

Illustrated London News.
Illustrirte Zeitung.
Institute of Mining Engineers' Transactions.
Iron Age.
Journal of American Chemical Society.
Journal of Applied Microscopy.
Journal of the Association of Engineering Societies.
Journal of the Chemical and Metallurgical Society of South Africa.
Journal of the Franklin Institute.
Journal of the Chemical Society, (London).
Journal of Geology.
Journal of the Institute of Electrical Engineers.
Journal of the Society of Chemical Industry.
Library Journal.
Lick Observatory Bulletin.
Liebig's Annalen der Chemie.
Life.
Literary Digest.
McClure's Magazine.
Metal Miner.
Metallographist.
Mineral Collector.
Mines and Minerals.
Mining and Scientific Press.
Mining Reporter.
Monthly Maroon.
Nature.
New York State Museum Bulletin.
Nineteenth Century.
North American Review.
Oesterreichische Zeitschrift für Berg und Hüttenwesen.
Outlook.
Philosophical Magazine.
Physical Review.
Political Science Quarterly.
Popular Astronomy.
Popular Science Monthly.
Publishers' Weekly.
Quarterly Journal of Geological Society.
Review of Reviews.
Revue Universelle des Mines.
Saturday Evening Post.
School of Mines Quarterly. (Columbia).
School Science.
Science.
Science Abstracts.
Science and Industry.
Scientific American.
Scientific American Supplement.
Scribner's Magazine.
Sibley Journal of Mechanical Engineering.
Silver and Gold.
Steam Engineering.
Stevens' Institute Indicator.
Stone.
Technology Quarterly.
Technology Review.
U. S. Forestry, Bureau of, Bulletin.
U. S. Geological Survey, Bulletin.
U. S. Labor, Department of, Bulletin.

U. S. Patent Office Official Gazette.
University of California Bulletin of Department of Geology.
University of Michigan Technic.
World's Work.
Zeitschrift für Analytische Chemie.
Zeitschrift für Angewandte Chemie.
Zeitschrift für Anorganische Chemie.
Zeitschrift für das Berg, Hütten und Salinewesen.
Zeitschrift für Praktische Geologie.

NEWSPAPERS.

Boston Transcript.
Chicago American.
Chicago Record-Herald.
Denver Evening Post.
Denver Republican.
Denver Times.
Golden Globe.
Golden Transcript.
London Times.
New York Tribune.
New York World.
Rocky Mountain News.

REQUIREMENTS FOR ADMISSION.

To the Freshman Class. All applicants must be at least seventeen years of age. Those who are graduates of "accredited" High Schools—i. e., schools of accredited standing, each in its own State, and with its respective State University or other leading institution—such students are examined only in plane and solid Geometry. In later years further requirements will probably be made, due notice of which will be given. The list of accredited High Schools in Colorado is as follows, and is taken bodily from the list assembled by the State University. Too much praise cannot be given this sister institution for her work in encouraging the High School system in Colorado.

List of Accredited Schools.

Denver High School District No. 1.
Denver High School, District No. 2.
Colorado Springs High School.
Greeley High School.
Pueblo High School, District No. 1.
Pueblo High School, District No. 20.
North Denver High School.
Georgetown High School.
Canon City High School.
Durango High School.
Aspen High School.
Fort Collins High School.
Golden High School.
Trinidad High School.
Denver Manual Training High School.
La Junta High School.
Central City High School.
Idaho Springs High School.
Longmont High School.
Montclair High School.
Fort Morgan High School.
Cripple Creek High School.

Leadville High School.
Victor High School.
Monte Vista High School.
Salida High School.
South Denver High School.
Las Animas High School.
Lamar High School.

Blank forms of application are furnished to those High Schools desiring to be placed on the accredited list. All applications will be considered by the faculty.

Candidates for the Freshman class *who are not graduates of any accredited High School* must sustain examinations in English, Geography, History, Algebra, Geometry, Physics, and Chemistry.

In Algebra there are required the first eighteen chapters of Wentworth's **Higher Algebra**, or an equivalent.

Geometry includes the whole of Plane and Solid. Applicants are expected to show clear notions of the nature of geometrical reasoning. Some original work is given in each paper. Wentworth's Geometry or an equivalent is recommended.

English, Geography, and History of High School standard are required.

In English, exercises are given in writing from dictation, definition, correction of phrases, some technical grammar, and a short essay.

The paper in Geography includes the general, physical and political divisions of the subject.

The paper in History includes both General and United States History. In the former, **Myers**, and in the latter, **Channing**, or their equivalents may be a basis for preparation.

The composition, chirography and general style of all papers will be considered in judging the candidate's fitness in English.

In Chemistry, Remsen's **Inorganic Chemistry** (briefer course), or an equivalent, is recommended.

In Physics, Carhart and Chute's **Physics**, or an equivalent, is recommended.

Entrance Examinations are held in May and September.

Examinations may be taken at the homes of the applicants, papers being forwarded to some responsible examiner. This applies to Freshmen and only to those living at a distance. All candidates for admission are advised to take the May examination.

An applicant who has passed his extrance examinations or presented an approved diploma, is put upon the "accepted" list, and is so notified. But he is not "admitted" until his matriculation fee is paid.

The experience of several years has shown that any student entering with less than the equivalent of a good High School course, **and that, too, thoroughly mastered,** has little chance for success.

Too much emphasis cannot be placed upon the necessity for a thorough preparation before entering upon the severe course of the School. It may be noted that among the desirable elements in preparatory training, these should be enumerated; in addition to the mathematics, at least one year in physics, chemistry, botany, and zoology; several years in Latin; one or two in French and German; a fair acquaintance with the great English classics, and above all, the ability to write clear, smooth, honest English.

Owing to the number of valuable papers which continually appear in the French and German language, it is highly desirable and strongly advisable that students attain a reading knowledge of these languages before entrance. Indeed, we may go further and say that a working knowledge of these languages is indispensable to anyone who cares to be a first-class specialist in any line.

Spanish is highly desirable for all who may operate later in countries where it is spoken. The School usually offers optional courses in Spanish.

The sciences are needed almost as much in preparation as are the mathematics. In this connection, attention should be called to the presentation of the individual laboratory note-book, for however soiled or mutilated, it is the best evidence of the scope and quality of the science course.

The Latin is needed, even for students of Mining and Metallurgy, for the intelligent basis that it furnishes for general grammar in its exquisite and uncompromising attention to the details of language. The English classics and good translations of foreign classics, are required for their style and more especially for their thoughts on mind and modes and morals—in a word, for the ideals of life which are the common heritage of the materialistic student of technical science as much as they are of his more cultured brother in the college of liberal arts—and the more because in our technical course at present, little if any time can be spared from technical subjects for the culture of language, literature, history, art, or philosophy.

Announcement of Future Requirements in English.

The examination in English is based on the requirements adopted by the Commission of Colleges in New England and recommended by the **Society for the Promotion of Engineering Education.**

1. The candidate will be required to write upon subjects familiar to him. His composition should be correct in spelling, punctuation, grammar, idiom, and division into paragraphs, and should be plain and natural in style. He will be judged by the manner in which he writes rather than by the quantity which he writes.

2. The candidate is required to have some acquaintance with good literature. The following works will serve as a basis, both for the examination in this and for the tests in the writing of English. With these books the applicant must be familiar. (All may be had in an inexpensive form.) They are, however, divided into two classes. Those marked (a) are to be read, and the candidate will be required to show a general knowledge of their subject matter and of the lives of the authors. Those marked (b) are to be studied thoroughly, so that the candidate shall be able to pass an examination upon their subject-matter and structure.

(a) Shakespeare's **The Merchant of Venice** and **Julius Caesar; The Sir Roger de Coverly Papers in the The Spectator;** Goldsmith's **The Vicar of Wakefield;** Coleridge's **The Ancient**

Mariner; Scott's **Ivanhoe**; Tennyson's **The Princess**; Lowell's **The Vision of Sir Launfal**; George Eliot's **Silas Marner**; Carlyle's **Essay on Burns**.

(b) Shakespeare's **Macbeth**; Milton's **Lycidas, Comus, L'Allegro**, and **Il Penseroso**; Burke's **Speech on Conciliation with America**; Macaulay's essays on **Milton** and **Addison**.

Note—The standing in English may be determined not solely by the rank attained in the examination in that subject; but, in addition to this, it is expected that the paper in history be written in correct and expressive English.

Admission Beyond Entrance Requirements.

To Advanced Standing. Applicants who are graduates of recognized collegiate institutions, or who have partially completed the course in such schools and who are candidates for the degree of the Colorado School of Mines, will be admitted, subject to the conditions enumerated below, to their appropriate stations; but in all cases they will be expected to pursue, and in order, from Freshman year on, those studies that they have not previously taken.

Candidates for advanced standing will be examined in all studies of the course below the class applied for, unless they can present credits sufficient, in the opinion of the Faculty, for admission without examination. The procedure at present is to accept the credits and admit the student on probation.

The Faculty reserves the right, however, to examine for admission to any higher standing than the first term of the Freshman year, irrespective of the credits brought from another institution.

It is necessary for all such applicants to bring with them the work that they have executed in Mechanical Drawing and in Descriptive Geometry.

There are no **special** courses. Graduate students attend lectures or practical work with regular classes, and are "specials" only in the sense that they may omit certain lines, and are not confined to the course of any one class.

Fire Assaying is excluded from these special or partial graduate courses, unless the student is a candidate for a degree and is regularly taking all the other work required.

Special Graduate Students. Graduates of any recognized collegiate institution, and who are not candidates for a degree, on the recommendation of the professor concerned, and with the permission of the Faculty, may take partial or special work as he may elect. Each case will be judged on its own merits and no case may be considered as a precedent for the careless overrunning of the standards which have given the degree of this School her merited reputation.

Degrees, Graduate Work, Etc. The course of the Colorado School of Mines is essentially a bachelor's course. The degree given at present is E. M. (Engineer of Mines); the special degree of E. E. (Electrical Engineer) will not be offered for the present, although the work in electrical engineering appropriately accessory to the regular E. M. degree will be presented more thoroughly than hitherto. Inasmuch as the engineering degree is not properly a bachelor's degree, it is probable that the title of the degree conferred by the Colorado School of Mines after some years will be that of B. S. (in Mining or in Metallurgy, resp.), reserving the Master's or Doctor's degree of E. M. for subsequent and real graduate work presented after graduation, either **in residence** or **in absentia.** The Trustees and Faculty are ready to move in the direction of graduate work as soon as the growth and equipment of the school shall allow.

THESES AND GRADUATION.

A thesis upon some practical subject is an important prerequisite to graduation.

Part of the work consists in visiting mines, smelters, power plants, and other works where the processes lectured upon may be seen in actual operation. Short trips of this description are frequent, while once a year a longer one is arranged, usually to some noted mining section.

When any prescribed trip is undertaken, having a practical bearing on the work of any course, the students in that course, and working for a degree to which that course is essential, shall be required to attend such trip, unless excused by a vote of the Faculty.

Expeditions of this kind afford abundant opportunities for the student to collect materials suitable for memoirs and theses.

All memoirs, theses and drawings which constitute a regular part of the school work, may be retained by the institution, and preserved as a part of the permanent record of the student who executed them.

Each Senior shall submit to the Faculty, not later than November 1st, the subject of his thesis, which subject must be approved by the instructor concerned. Each thesis must be typewritten or printed, on eight and one half by eleven inch paper, and bound in book form.

The completed theses must be handed in not later than May fifteenth.

Theses must be completed in final form, and handed to the librarian, before the delivery of diplomas. No diploma will be delivered until this requirement has been met.

EXAMINATIONS AND RE-EXAMINATIONS.

All students are expected to take the full regular quota of work, pursuing in order, as time and strength shall permit, all the studies of the regular course as laid down in the schedule, pages 43 to 46.

In case of enforced irregularities from natural limitations, poor preliminary training, lack of application, or sickness, the suggestion which will mainly guide the disposition of each individual case, is the principle of the logical continuity of studies, in their mutual relations of preparation and sequence.

Students should complete all Freshman studies before entering on those of the Junior year, and similarly, the Sophomore studies before entering the Senior year.

Each case will be considered on its merits, as natural exceptions and those that cannot be anticipated may present themselves. But no rule shall be so applied as to work hardship or injustice to a student, who really deserves and is fitted to anticipate the studies of a later year.

Regular examinations, which all students are required to attend, are held at the end of each semester on the various subjects pursued during the semester.

A condition incurred during the first semester may be removed by a first re-examination, held before the end of the second semester, at a regular date set for that purpose, and, in case of failure to pass, by a second re-examination, held in September at a regular date set for that purpose, before the beginning of the semester. Until so removed, the said condition shall remain in effect.

A condition incurred during the second semester may be removed by a first re-examination, held at a regular date set for that purpose, before the opening of the school in September, and in case of failure to pass, by a second re-examination, held before the end of the first semester of the academic year, at a regular date set for that purpose, and until so removed, the said condition shall remain in effect.

Failure to remove any condition within a year will require that the subject be repeated in the class room.

EXPENSES.

Tuition is free to bona fide residents of Colorado. Students from other states pay fifty dollars per semester, or one hundred dollars a year. All are charged for material consumed or broken.

The following are the various fees and charges:

Matriculation fee (paid upon admission)	$ 5.00
Athletic Association, annual dues (payable in two installments	10.00
Locker fee (paid once only, for the course)	1.00

Of the other expenses a part, as shown below, are school charges, for such material, or wear and tear, as belong to the school issue of apparatus and supplies. Text books and drawing instruments and supplies are not charged in school accounts, but are inserted in order to give a fair idea of the total expense, exclusive of board, etc.

Freshman Class.

General Chemistry fee	$10.00
General Chemistry, deposit (apparatus)	10.00
Qualitative Analysis, fee	20.00
Qualitative Analysis, deposit (apparatus)	15.00

(The "deposit" is often not consumed, in which case the balance is returned. The "fee" is also for material, chiefly chemicals. No part of it is returnable.)

Texts for Freshman course (both terms)	$15.00
Drawing Supplies, complete	20.00

Sophomore Class.

Quantitative Analysis, fee (for the year)	$20.00
Quantitative Analysis, deposit	15.00
Assaying, deposit	25.00
Supplies in Drawing Department	5.00
Blowpipe outfit (Mineralogy)	12.00
Text books for the year, total	15.00

The only fee charged in the department of Geology and Mineralogy is a fee of twelve dollars for the entire course in Mineralogy. This fee covers the expense of the blow-pipe outfit which the student thus buys outright, and partially pays the cost of material used up and destroyed in connection with the courses in crystallography, blow-pipe work, and determinative mineralogy.

Junior Class.

Surveying course (use of instruments)	$10.00
Supplies used in Surveying course	2.00
Text books for the year	35.00

Senior Class.

Graduation fee	$ 5.00
Text books for the year	12.00

There are other expenses incidental to *mining and metallurgical trips*, some of which are obligatory. These expenses for the entire course are always within one hundred dollars, but are necessarily variable.

The preparation of theses (Senior) involves expenses, which vary greatly according to the nature and treatment of the subjects. For laboratory work in special cases a deposit of fifteen dollars is required.

Students leaving in mid-term, except on account of sickness, are not entitled to return of fees.

All charges are payable in advance.

The expenses of the school year (tuition fee excluded) need not exceed three hundred and fifty dollars. Board and good accommodation can be had at from five to seven dollars a week.

Many applicants write asking whether the institution can furnish employment, or whether work may be secured in Golden, to aid them in meeting expenses. The school, however, cannot employ students, and the chances for employment in Golden are very slight. It should be added that the course is far too exacting to allow any student much time for outside work.

No student will be allowed to graduate while indebted to the school.

The Trustees reserve the right to make incidental changes in fees without printed notice, as new and unforeseen emergencies may arise.

SCHEDULE OF COURSES.

FRESHMAN YEAR.

First Semester.

Mathematics	1	Algebra	5 hours*
Mathematics	3	Trigometry	3 hours
Machine Design and Drafting	1	Descriptive Geometry	2 hours
Machine Design and Drafting	3	Mechanical Drafting	9 hours
Chemistry	1	General	3 hours
Chemistry	3	General Laboratory	6 hours

Second Semester.

Mathematics	2	Algebra	5 hours
Mathematics	4	Analytical Geometry	3 hours
Machine Design and Drafting	2	Descriptive Geometry	2 hours
Machine Design and Drafting	4	Descriptive Geometry Drawing	6 hours
Chemistry	2	General	3 hours
Chemistry	4	Qualitative	9 hours

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*Hours actually employed per week.

SOPHOMORE YEAR.

First Semester.

Mathematics	7	Calculus	3 hours*
Mathematics	5	Analytical Geometry	2 hours
Mineralogy	3	Crystallography	5 hours
Physics	1	Mechanics, Sound, Light	4 hours
Physics	3	Laboratory	2 hours
Machine Design and Drafting	5	Mechanism	1 hour
Machine Design and Drafting	7	Mechanical Drafting	4 hours
Chemistry	7	Gravimetric Analysis	1 hour
Chemistry	5	Gravimetric Analysis	9 hours
Assaying	1	Fire Assaying	

Second Semester.

Mathematics	6	Calculus	5 hours*
Mineralogy	5 and 6	Blowpiping Analysis and Determinative Mineralogy	9 hours
Physics	2	Heat and Electricity	4 hours
Physics	4	Laboratory (Heat and Electricity)	2 hours
Machine Design and Drafting	6	Mechanism	2 hours
Machine Design and Drafting	8	Mechanism Drafting	3 hours
Chemistry	6	Volumetric Analysis	6 hours
Chemistry	8	Volumetric Analysis	1 hour
Assaying	1	Fire Assaying	

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* Hours actually employed per week.

JUNIOR YEAR.

First Semester.

Geology	1	General Geology	4 hours*
Mechanics	1	Theoretical Mechanics	3 hours
Surveying	1	Lectures	3 hours
Surveying	3	Field Work	9 hours
Metallurgy	1	General Principles of Metallurgy	6 hours
Machine Design and Drafting	9	Machine Design	2 hours
Machine Design and Drafting	11	Machine Design	6 hours
Mechanics	9	Testing Laboratory	1 hour

Second Semester.

Geology	2	Lithology	2 hours
Geology	4	Economic Geology	2 hours
Mechanics	2	Dynamics	3 hours
Metallurgy	2	Metallurgy of Copper	6 hours
Surveying	2	Lectures	2 hours
Surveying	4	Field Work	9 hours
Mechanics	4	Graphics	5 hours
Machine Design and Drafting	10	Machine Design	1 hour
Machine Design and Drafting	12	Machine Design Drafting	3 hours

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* Hours actually employed per week.

SENIOR YEAR.

First Semester.

Metallurgy	3	Metallurgy of Gold, Silver, etc.	7 hours*
Hydraulics	1	Hydraulic Motors	3 hours
Hydraulics	3	Hydraulic Laboratory	3 hours
Thermodynamics and Power Transmission	1 and 2	Thermodynamics and Steam Engine	2 hours
Mining	1	Hoisting, Pumping, etc.	5 hours
Mechanics	5	Structural Details	2 hours
Mechanics	7	Structural Design	6 hours
Cement Laboratory	9		1 hour
Chemistry	9	Technical Chemistry	2 hours

Second Semester.

Metallurgy	4	Metallurgy of Iron, Steel, Lead, etc	7 hours
Thermodynamics and Power Transmission	2 and 6	Steam Engine and Power Trans.	5 hours
Thermodynamics and Power Transmission	4 and 8	Steam and Electrical Laboratory	3 hours
Mining	2	Tunneling, Sinking, etc.	5 hours
Mining	4	Laboratory	3 hours

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* Hours actually employed per week.

DESCRIPTION OF DEPARTMENTS AND COURSES.

DEPARTMENT OF MATHEMATICS.

Professor Stockton.	Mr. Haldane, Mr. Berry.
Assistant Professor Weiss.	Mr. Gebhardt.

FIRST SEMESTER.

1. ALGEBRA. Assistant Professor Weiss and Mr. Berry.

The course begins with a review of some of the more fundamental portions of the subject, including Theory of Exponents, Surds, Imaginary Numbers, Simple and Quadratic Equations, together with a thorough drill in the theory and use of Determinants.

Five hours a week during the Freshman year.

Texts: Wells' **College Algebra;** Peck's **Elements of Determinants.**

3. TRIGONOMETRY. Mr. Haldane and Mr. Gebhart.

Plane and spherical trigonometry, including a working knowledge of Logarithms and the use of tables. Many practical problems are given to the students to be worked out.

Three hours a week during the first semester of the Freshman year.

Texts: Crawley's **Trigonometry;** Jones' **Logarithmic Tables.**

5. ANALYTICAL GEOMETRY. Professor Stockton.

The Conic Sections. The nature of the conic corresponding to the general equation of the second degree is determined.

The analytical geometry of three dimensions.

Three times a week during the first semester of the Sophomore year.

Requires courses 1, 3 and 4 in Mathematics.

Text: Tanner and Allen's **Analytical Geometry.**

7. CALCULUS. Professor Stockton.

Differential Calculus. Differentiation; also the general nature and use of Integral Calculus is explained. The expansion of functions. Partial differentiation. A discussion of tangents, asymptotes, points of infection, etc.

Lectures three times a week during the first semester of the Sophomore year.

Requires courses 1, 2, 3 and 4 in Mathematics.

Text: Osborne's **Calculus.**

SECOND SEMESTER.

2. ALGEBRA. Assistant-Professor Weiss and Mr. Berry.

During this term the time is mainly devoted to the Theory of Equations, Probability, Series, Binomial Theorem, and the Logarithmic and Exponential Series.

Five hours a week during the second semester of the Freshman year.

Requires course 1 in Mathematics.

Text: Wells' **College Algebra.**

4. ANALYTICAL GEOMETRY.

Mr. Haldane and Mr. Gebhardt.

The point, straight line and circle are treated quite fully, the conic sections are defined, and the general theorems (relating to tangents, normals, poles and polars, and diameters) are derived.

Three hours a week during the second semester of the Freshman year.

Requires courses 1 and 3 in Mathematics.

Text: Tanner and Allen's **Analytical Geometry.**

6. CALCULUS. Professor Stockton.

The problem of maxima and minima of analytical functions is treated, the necessary and sufficient conditions being established in determinant form.

In Integral Calculus; general methods of integration are taken up and numerous examples worked. Then the applications of integration to plane curves, areas, surfaces, volumes, moments of inertia, centre of mass, etc., are taken up.

Lectures five hours a week during the second semester of the Sophomore year.

Courses 5 and 7 are required.

Text: Osborne's **Calculus.**

DEPARTMENT OF PHYSICS.

Professor Hill. Assistant Professor Hazard.

FIRST SEMESTER.

1. MECHANICS, SOUND AND LIGHT. Professor Hill.

This course is given by lectures, illustrated by experiments, and by recitations. It is required of all Sophomores.

Lectures three times per week. Recitations (two sections) once each week.

Courses 1, 2, 3 and 4 in Mathematics required, and must be preceded or accompanied by course 7 in Mathematics.

Texts: Carhart's **University Physics;** Hasting and Beach's **General Physics.**

3. LABORATORY COURSE IN MECHANICS, SOUND AND LIGHT. Assistant-Professor Hazard.

Thirty experiments are performed by each student, all of a quantitative nature.

Laboratory work (two sections) two days per week.

Accompanies course 1, Physics.

Texts: Ames and Bliss's **Manual of Experiments in Physics;** Nichol's **A Laboratory Manual of Physics.**

5. ADVANCED LABORATORY COURSE IN MECHANICS. Professors Hill and Hazard.

Three hours each week. Hours to be arranged with instructor.

Requires courses 1, 2 and 3 in Physics.

SECOND SEMESTER.

2. HEAT AND ELECTRICITY. Professor Hill.

This course is given by lectures, illustrated by experiments, and is a continuation of course 1.

Lectures three times each week. Recitations, each section, one hour per week.

Courses 1, 2, 3, 4 and 7 in Mathematics required and should be preceded by course 1, Physics.

Texts: Carhart's **University Physics;** Hasting and Beach's **General Physics.**

4. LABORATORY COURSE IN ELECTRICITY AND HEAT.

Professors Hill and Hazard.

Thirty quantitative experiments are performed by each student.

Laboratory work (two sections) two hours per week during the second semester of the Sophomore year.

Accompanies course 2, Physics.

Texts: Ames and Bliss's A Manual of Experiments in Physics; Nicholl's Laboratory Manual of Physics and Electricity.

6. ADVANCED LABORATORY COURSE IN HEAT.

Professor Hill.

This course includes such experiments as the determination of the calorific power of fuels, the mechanical equivalent of heat, the P. V. curves of vapors, etc.

It requires at least one afternoon of four hours each week. The course is elective and the hours are to be arranged with the instructor.

Requires courses 1, 2, 3 and 4, in Physics.

8. ADVANCED LABORATORY COURSE IN ELECTRICAL MEASUREMENTS.

Professors Hill and Hazard.

This course may be elected by those who have completed courses 1, 2, 5 and 6.

Hours to be arranged with instructor.

10. ADVANCED LABORATORY COURSE IN MAGNETISM.

Professors Hill and Hazard.

This includes the study of hysteresis curves, the testing of transformers, etc. This course may be elected by those who have completed courses 1, 2, 3, 4 and 8.

Hours to be arranged with the instructor.

DEPARTMENT OF CHEMISTRY.

Dr. Hartman. Mr. Test, Dr. Palmer.

The following courses of instruction are offered in the department of Chemistry, all of which are required of candidates for the degree of E. M.:

FIRST SEMESTER.

1. GENERAL CHEMISTRY (Lecture course). Dr. Palmer.

Lectures and recitations on the theories and principles of Chemistry, with special reference to their applications in practical work. The typical elements are first studied at length and then the remaining elements according to the periodic grouping. Technical processes receive much attention, and the latest developments of chemical theory are discussed. A feature of the course is the attention paid to stoichiometrical calculations. The lectures are illustrated by numerous experiments and the mineralogical collections are constantly used for illustration of the naturally occurring compounds of Chemistry.

Text: Richter's **Inorganic Chemistry.**

(The works of Remsen, Erdmann, and Roscoe and Schorlemmer are recommended for the supplementary reading.)

Freshman year, first semester, three hours weekly.

3. GENERAL CHEMISTRY (Laboratory course).
Dr. Hartman, Mr. Test.

A course designed to supplement the work of course 1. Advanced experimental work; studies of reactions; spectroscopy; chemical preparations, and studies introductory to qualitative analysis are included in the work of the course. No single text is used and the student must continually refer to the literature for information and data.

Freshman year, first semester, two afternoons weekly.

5. QUANTITATIVE ANALYSIS (Laboratory course).
Dr. Hartman, Mr. Test.

The course of instruction in Quantitative Analysis begins with the analysis of simple salts and passes to that of more complex bodies, as ores and alloys. A varied series of determinations is required which illustrate the most important types of gravimetric methods. A large supply of carefully checked samples is available, and students must show a high degree of accuracy in their work. Among some of the exercises of the course are the analysis of pyrolusite, dolomite, wolframite, silicates, coal, iron ore, and alloys.

Text: Cairn's **Quantitative Analysis.**

Sophomore year, first semester, three afternoons weekly.

Courses 1, 2, 3 and 4 in Chemistry are required.

7. QUANTITATIVE ANALYSIS (Lecture course).

Dr. Hartman.

A course of lectures on the work of course 5, and the applications of chemical theory to analytical work.

Sophomore year, first semester, one hour weekly.

9. TECHNICAL CHEMISTRY (Lecture course). Dr. Hartman.

A course of lectures on selected topics of interest to engineers. Among other subjects, the analysis of cyanide solutions, gases, oils, paints, explosives, fuels, water, petroleum and asphalt, cements and clays, alloys, and iron and steel are taken up.

Senior year, first semester, two hours weekly.

11. THEORETICAL CHEMISTRY (Lecture course).

Dr. Palmer.

A course of lectures on advanced theoretical topics, including a discussion of the relations of the chemistry of carbon to general chemistry, particularly in connection with considerations of structure. Also a study of the principles of chemical research, and discussions of the latest discoveries of chemistry.

(Senior year, first semester, two hours weekly.)

SECOND SEMESTER.

2. GENERAL CHEMISTRY (Lecture course). Dr. Hartman.

A continuation of course 1.

Freshman year, second semester, three hours weekly.

Courses 1 and 3 in Chemistry are required.

4. QUALITATIVE ANALYSIS (Laboratory course).

Dr. Hartman, Mr. Test.

The reactions of the important basic and acidic elements are rationally studied and their identification and separation in mixtures of varying complexity is required. In addition to the analysis of simple solutions, the analysis of ores, minerals and insoluble products is taught, and the reactions of the rare elements are taken up to some extent. Spectroscopic work forms part of the course. Every effort is made to avoid mechanical work, and all students must write out the reactions and separations as they occur, and submit their notes for correction. Frequent quizzes are held and the theory of analysis is emphasized.

Freshman year, second semester, three afternoons weekly.

Text: Medicus's **Qualitative Analysis** (Marshall's Translation.)

Courses 1, 2 and 3 in Chemistry are required.

6. QUALITATIVE ANALYSIS (Lecture course). Dr. Hartman.

A course of lectures on the principles of Qualitative Analysis, supplementary to course 4.

Freshman year, second semester, one hour weekly.

8. QUANTITATIVE ANALYSIS (Laboratory course).

Dr. Hartman, Mr. Test.

This course (which is the continuation of course 5) consists largely of exercises in Volumetric analysis, and the applications of gravimetric and volumetric methods to commercial requirements. Students are especially drilled to attain speed and capacity, without interfering with accuracy. For these exercises a large number of smelters' and assayers' samples are available.

Among the exercises of the course are acidimetry and alkalimetry, with the use of indicators; assay of bleaching powders and cyanide solutions; the volumetric determination of iron, copper, manganese, zinc, lime, lead and arsenic in ores and furnace products.

Sophomore year, second semester, two afternoons weekly.

Courses 1, 2, 3, 4, 5, 6 and 7 in Chemistry are required.

10. QUANTITATIVE ANALYSIS (Lecture course).

Dr. Hartman.

A continuation of course 7, bearing chiefly on Volumetric analysis.

Sophomore year, second semester, one hour weekly.

In addition to the regular courses required of condidates for the degree of E. M., the following courses are offered open to graduate students, or regular students who can present credits in the required courses.

12. THE ANALYSIS OF IRON AND STEEL (Laboratory course). Dr. Hartman.

The chemical examination of irons, steels, and "ferro" alloys, according to the latest methods.

Text: **The Chemical Analysis of Iron.** Blair.

Courses 1, 2, 3, 4, 5, 6 and 8 in Chemistry are required.

Hours to be arranged.

14. GAS ANALYSIS (Laboratory course). Dr. Hartman.

The analysis of mine, flue, illuminating, and chamber-gases, according to the methods of Hempel, Bunte, Elliott, Orsat, Lunge, Winkler, and others.

Texts: The works of **Hempel** and **Winkler.**

Courses 1, 2, 3, 4, 5, 6 and 8 in Chemistry are required.

Hours to be arranged.

16. TECHNICAL CHEMICAL ANALYSIS (Laboratory course.) Dr. Hartman.

The analysis of lubricating oils, petroleum, asphalt, explosives, fuels, boiler waters, paints, cements, and clay.

Texts: Stillman's **Engineering Chemistry**; Phillips' **Engineering Chemistry.**

Courses 1, 2, 3, 4, 5, 6 and 8 in Chemistry are required.

Hours to be arranged.

18. ORGANIC PREPARATIONS (Laboratory course).

Dr. Hartman.

A short course in the study and preparation of some of the more important organic compounds.

Texts: The works of Remsen, Fischer, Levy, and Bender and Erdmann.

Courses 1, 2, 3, and 4 in Chemistry are required.

Hours to be arranged.

20. PHYSICAL CHEMISTRY (Laboratory course).

Dr. Palmer.

A course in Physico-chemical methods, including molecular weight determinations, conductivity determinations, and a study of thermochemical methods.

Courses 1, 2, 3, 4, 5, 6, 8 and 11 in Chemistry are required.

Hours to be arranged.

All students in laboratory courses must make a deposit with the registrar, in addition to the payment of the regular fees, before receiving supplies and apparatus. In case of excessive withdrawal of apparatus another deposit may be required.

Students are not permitted to do any work outside of that outlined in the regular courses except under the direction of the professor in charge.

DEPARTMENT OF MACHINE DESIGN AND DRAFTING.

Professor Curtis.	Mr. Haldane.
Assistant Professor Hazard.	Mr. Gebhardt.

FIRST SEMESTER.

1. DESCRIPTIVE GEOMETRY.

Assistant Professor Hazard, Mr. Haldane and Mr. Gebhardt.

The course covers the first seventeen problems and the matter between problems seventeen and eighteen of Church's **Descriptive Geometry.** The method of instruction is by lectures and recitations. Each student recites on every problem individually.

Two hours a week during the first semester of the Freshman year.

Must be preceded or accompanied by course 3, Machine Design and Drafting.

Text: Church's **Descriptive Geometry.**

3. MECHANICAL DRAWING.

Assistant Professor Hazard, Mr. Haldane and Mr. Gebhardt.

All efforts during the early part of the work are directed towards making the student thoroughly acquainted with, and exercised in, the proper use of his drawing instruments and drafting supplies in general. The work then proceeds with mechanical and free hand lettering, line shading, tinting, shading with tints, and conventional tints for different materials. Great stress is laid on the work in free hand lettering. There are twelve of these mechanical sheets, a title page for the mechanical sheets and a title page for the descriptive geometry sheets. These two title pages may be a part of the second semester's work.

Three afternoons a week during the first semester of the Freshman year.

Texts: Morris' **Geometrical Drawing;** Curtis and Hazard's **Freshman Drawing Data.**

5. MECHANISM. Professor Curtis.

Lectures and recitations. The course consists of the elementary principles of mechanism, including linear and angular velocity, graphic representation of velocity, modes of transmitting motion, velocity ratio, directional relation, motion by rolling contact, classification of gearing, and motion by sliding contact.

One hour a week during the first semester of the Sophomore year.

Courses 1, 3, and 4 in Mathematics are required and it must be preceded or accompanied by course 7, Mathematics, and courses 2 and 4, Machine Design and Drafting.

Text: Stahl & Wood's **Mechanism.**

7. MECHANICAL DRAWING. Professor Curtis.

This course is intended to acquaint the student with that part of mechanical drawing in which the information comes from rough sketches from which the student is required to work up a thoroughly practical sheet. The work covers the matter of border lines, titles, and other printing, dimension and center lines, dimensions, the use of shaded lines, and the arrangement of the views on the sheet.

The problems given all require the proper application of descriptive geometry for their representation. They include such parts as pipes, flanges, elbows with their developments, bosses, levers, braces, screw threads, springs, nuts, and brackets. There are in all five sheets. The process of blue-printing is also given during this time.

Two afternoons a week during the first semester of the Sophomore year.

This course requires courses 2 and 4, Machine Design and Drafting.

Text: Curtis's **Sophomore Drawing Data.**

9. MACHINE DESIGN. Professor Curtis.

Lectures and recitations. The course as given is based, on the one hand, on the strength of materials, and on the other, on practical requirements. All formulae are derived and proved wherever possible, empirical formulae being used only where absolutely necessary. The work of this semester is devoted entirely to fastenings, and includes the proportioning of bolts and nuts of all forms, keys and colters, pipes and pipe joints, and riveted work.

Two hours a week during the first semester of the Junior year.

This course requires courses 5 and 6, Machine design and Drawing, and must be preceded or accompanied by course 1, Mechanics.

Texts: Low and Bevis's **Machine Drawing and Design.**

11. MACHINE DESIGN DRAWING. Professor Curtis.

The first two sheets of this semester are on belting, and are a part of the mechanism drawing. The next work is on the design of assay furnaces; then follows the drawing based on the work in machine design.

This follows closely the work in the class room, the subject of fastenings, as outlined, being covered in this semester.

This course requires courses 7 and 8, and must be preceded or accompanied by courses 9 and 10, Machine Design and Drafting.

SECOND SEMESTER.

2. DESCRIPTIVE GEOMETRY.

Assistant Professor Hazard, Mr. Haldane, Mr. Gebhardt.

The course covers the tangent problems, intersection problems, shades and shadows, and isometric projections, as given in Church's **Descriptive Geometry.**

Second semester Freshman year, two hours a week.

Course 1, Machine Design and Drafting is required.

Text: Church's **Descriptive Geometry.**

4. DESCRIPTIVE GEOMETRY DRAWING.

Assistant Professor Hazard, Mr. Haldane, Mr. Gebhardt.

This is in connection with the work in Descriptive Geometry, and includes warped surfaces, surfaces of revolution, tangent surfaces, intersections, shades and shadows, and isometric projections.

Three afternoons a week.

Texts: Church's **Descriptive Geometry**; Curtis and Hazard's **Freshman Drawing Data.**

6. MECHANISM. Professor Curtis.

This course continues with the study of gear-teeth of the cycloidal system, the involute system, approximate system, bevel gearing, cams, worm-gearing, motion by link work, motion by wrapping connectors, belts and pulleys, trains of mechanism, combinations, and straight line motions.

Lectures two hours weekly during the Sophomore year.

Text: Stahl and Wood's **Elementary Mechanism.**

8. MECHANISM DRAWING. Professor Curtis.

This course is given in connection with the course in Mechanism and includes lobed wheels, spur-wheels, bevel-wheels, sprocket-wheels, cams, and worm and wheel.

The smallest possible amount of data is given out so as to place the student on his own responsibility in shaping his sheets.

There are in all seven sheets.

One afternoon weekly, Sophomore year.

This course requires courses 2, 4, and 5, Machine Design and Drafting, and it must be preceded or accompanied by course 6.

10. MACHINE DESIGN. Professor Curtis.

The work of this semester is on that part of machine design pertaining to the transmission of power, and includes the proper proportioning of shafting, shaft couplings, bearings, brackets and hangers, pulleys and belt drives, wire and cotton rope drives, and tooth gearing, also the laying out of shafting for mills, including the arrangement of the necessary parts.

One hour per week of the Junior year.

This course requires course 9, Machine Design and Drafting.

Text: Low and Bevis's **Machine Drawing and Design.**

12. MACHINE DESIGN DRAWING. Professor Curtis.

The whole of the work of this semester is done in connection with the class room work in Machine Design and includes such work as is outlined in connection with that subject for the second semester.

One afternoon per week of the Junior year.

This course requires course 11, Machine Design and Drafting.

DEPARTMENT OF SURVEYING.

Professor Stockton. Assistant Professor Weiss and Mr. Berry.

FIRST SEMESTER.

1. SURVEYING. Assistant Professor Weiss.

Instruction is given in the theory of the adjustment of the transit and level, the principles of land surveying, topographical surveying and railroad work. The theory of the use of the Plane Table and also that of the Aneroid Barometer are given.

Three lectures a week during the first semester of the Junior year.

Courses 1, 2, 3, 4, 5, and 6 in Mathematics and courses 1, 2, 3, 4, 7 in Drawing required.

Texts: Johnson's **Theory and Practice of Surveying;** Hodgman's **Field Manual;** Pence and Ketchum's **Surveying Manual;** Nagle's **Field Manual for Railroad Engineers;** Searles' **Railroad Spiral.**

3. FIELD SURVEYING.

Professor Stockton, Assistant Professor Weiss, and Mr. Berry.

This course consists in adjusting instruments, traverse surveys, calculation of areas and distances, stadia work and the laying out of a short railway line. All the problems are platted in the office and the calculations made in a regular book kept for that purpose.

Field and office work, three afternoons a week during the first semester of the Junior year.

This course accompanies course 1.

SECOND SEMESTER.

2. MINING SURVEYING. Assistant Professor Weiss.

Under this head will be considered the theory of the determination of the true meridian by means of the various solar attachments and by direct observation of the sun and of a circumpolar star; a careful discussion of the principles and methods used in locating and patenting mining claims, and in underground surveying, will be given. The lectures delivered on these subjects enter into the detail with which they are connected, and touch upon the Mining Law relating to surveyors and the patenting of mining property. The remaining time will be devoted to the outlines of the subject of geodetic surveying.

Lectures twice a week during the second semester of the Junior year.

This course requires course 1, Surveying.

Texts: Johnson's **Theory and Practice of Surveying**; Morrison's **Mining Rights.**

4. FIELD SURVEYING.

Professor Stockton, Assistant Professor Weiss and Mr. Berry.

This course includes field practice in determining the true meridian by the different methods. Each party undertakes the complete survey of a mining claim for patent, including the making of the Preliminary Plat and the writing up of the Field Notes according to the requirements of the Surveyor General's office.

The surveys of a number of available mines are made, and the proper maps and sections drawn. A base line is measured with a three hundred foot steel tape, and all corrections made so as to eliminate errors of sag, pull, temperature, and grade. On this base rests a quadrilateral whose angles are measured by the repeating method. These measured angles are adjusted and the sides computed.

Field and office work three afternoons a week during the second semester of the Junior year.

This course accompanies course 2, Surveying.

DEPARTMENT OF GEOLOGY AND MINERALOGY.

Professor Patton. Mr. Eggleston.

FIRST SEMESTER.

1. GENERAL GEOLOGY. Professor Patton.

This course embraces (a), Dynamical Geology; (b), Structural Geology; (c), Historical Geology. It is based mainly on text book work which is supplemented by lectures and illustrations, the intent being to give a fair knowledge of the principles of the subject such as an intelligent mining engineer should possess. This class room work later in the year is further supplemented by excursions in the neighborhood of Golden.

Four hours a week during the first semester of the Junior year.

Texts: Le Conte's **Text Book of Geology.**

3. CRYSTALLOGRAPHY.

Professor Patton and Mr. Eggleston.

This course is intended to give a thorough comprehension of the fundamental principles of the subject with a view to utilizing this knowledge for the practical determination of minerals. Instruction is given through lectures, followed by laboratory practice, and through individual quizzes. The material presented covers the six crystal systems and most of the hemihedral and tetartohedral divisions. The practical work embraces the study and determination of wooden crystal models to the number of about twelve hundred, and the identification of crystal forms on about three hundred natural crystals.

Five hours a week until Christmas, during the first semester of the Sophomore year.

Texts: Patton's **Lecture Notes on Crystallography.**

5. BLOWPIPE WORK. Professor Patton and Mr. Eggleston.

In this course only the most characteristic reactions of the more commonly occurring elements are presented, namely, those which will be found necessary for the proper determination of the minerals presented in the course in Determinative Mineralogy. The blowpipe outfit for this course is furnished by the school, and is paid for by the special fee required for the complete course in mineralogy, and becomes the property of the student.

Thirty hours altogether, Sophomore year.

Courses 1, 2, 3, 4 and 6 in Chemistry required.

Texts: Moses and Parson's **Mineralogy, Crystallography, and Blowpipe Analysis.**

SECOND SEMESTER.

2. LITHOLOGY. Professor Patton and Mr. Eggleston.

This course is based primarily on lectures which are followed by practical rock determination and by excursions. The intent of the course is to give a familiarity with all the more commonly occurring rock types with ability to determine the same in the field. With this object in view, attention is directed mainly to the macroscopic properties of rocks. For this purpose collections containing over eleven thousand specimens have been arranged and made accessible to the students.

Three hours a week during the second semester of the Junior year.

Courses 1, 2, 3, 4, and 6 in Chemistry and courses 3, 5, and 6 in Geology and Mineralogy are required.

Text: Kemp's **Handbook of Rocks.**

4. ECONOMIC GEOLOGY. Professor Patton.

This important subject, which has heretofore been presented incidentally in connection with courses in mining and geology, will, after the present school year, be placed under the department of Geology and Mineralogy. Owing to the limited resources of the School of Mines in the past it has been impossible to give this subject the attention it deserves. It will be the policy of the department gradually to extend instruction in Economic Geology, including Ore Deposits, in so far as circumstances will allow.

Courses 1, 2, 3, 5, and 6 in Geology and Mineralogy are required.

6. SYSTEMATIC AND DETERMINATIVE MINERALOGY.

Professor Patton and Mr. Eggleston.

This subject is taught by means of lectures, text books and laboratory practice. Altogether about two hundred and fifty mineral species are presented. In the laboratory practice each student is expected to determine and recite upon about twenty-five hundred mineral specimens, and he is supposed to become familiar with the characteristic physical properties that enable one to recognize the mineral species wherever met, with the aid of only a magnifying glass and a pocket knife. Two extensive collections have been prepared to be used in this course, one a type collection of thirty-seven hundred specimens, and the other a student's working collection of twenty-one thousand specimens.

Ten hours a week for fifteen weeks during the second semester of the Sophomore year.

Courses 1, 2, 3, 4, and 6 in Chemistry and courses 3 and 5 in Geology and Mineralogy are required.

Texts: Moses and Parson's Mineralogy, Crystallography and Blowpipe Analysis.

DEPARTMENT OF MECHANICS AND CONSTRUCTION.

Professor Filkins.

FIRST SEMESTER.

1. THEORETICAL MECHANICS. Professor Filkins.

The course consists of the theoretical study of mechanisms and materials. Statics of a material point and of rigid bodies; centers of gravity or centroids; chains, cords and cables; moments of inertia of plane figures; stresses and strains; tension; shearing; compression; torsion; flexure; combined torsion and flexure; elastic curves; safe loads; applications to commercial forms; oblique forces; columns; continuous beams.

Lectures and recitations three times a week during the first semester of the Junior year.

Courses 1, 2, 3, 4, 5, 6, and 7 of Mathematics, and 1 and 2 of Machine Design and Drafting are required.

Texts: Church's Mechanics of Engineering.
Church's Notes and Examples in Mechanics.
Cambria Steel.
Pierce's Short Table of Integrals.
Original Problems.

3. ADVANCED GRAPHICS. Professor Filkins.

Elective. An application of graphics to the solution of masonry problems. Right arches of masonry. Arch-ring, voussoirs, soffit, intrados, extrados, spandrel, crown, key stone, rise, and span. Mortar. Friction. Resultant and maximum pressure. True linear arch. Load contour. Symmetrical and non-symmetrical loadings on symmetrical arches. Abutments. Arch ribs. Special equilibrium polygon. Thrust. Shear. Moment. Angular Change. Deflections. Graphical arithmetic. Continuous rib, free to slip on abutments. Three-hinged rib. Two-hinged rib. Continuous rib with fixed ends. Applications of Professor Eddy's Graphical method. Temperature. Rib shortening. Variable cross section. Scheffler's theory. Continuous girders by graphics. Thatcher's concrete steel construction with variations. Expanded metal and similar constructions.

Hours to be arranged.

Courses 1, 2, and 4, in Mechanics and Construction are required.

Texts: Church's Mechanics of Engineering.

Baker's Masonry Construction.

5. (a) STRUCTURAL DETAILS. Professor Filkins.

Theory. Definitions and dimensions of parts. Housing, notching, mortise and tenon, dove-tailing, lag screws, dowels, lugs, keys, brace blocks, nuts and washers, etc. Unit stresses. Loading. Splicing; fishing, scarfing. Deepened beam. Articulated trussed beam solved graphically and by method of "least work." Wooden roof truss; rafters, purlins, upper chord, lower chord, tie-rods, end joint, corbel, anchorage. Pin and riveted steel roof trusses.

Recitations and lectures twice a week during the first semester of the Senior year.

(b) DESIGN. Professor Filkins.

Tabled fish-plate joint. Plain wrought-iron fish-plate joint. Deepened beam. Trussed beam. Wooden roof truss. Steel roof truss. Pin or rivet connections. Steel and masonry buildings. Wood and steel gallows frames.

Two afternoons a week during the first semester of the Senior year.

Courses 1, 2, and 4 in Mechanics and Construction are required.

Texts: Howe's Roof Trusses in Wood and Steel.

Merriman and Jacoby's Roofs and Bridges.

Fowler's Specifications for Roofs and Buildings.

Cambria Steel.

Jacoby's Structural Details, sheets.

Baker's Masonry Construction.

7. TESTING LABORATORY. Professor Filkins.

Determination of the strength and stiffness of building materials. Cast iron, wrought iron, steel and wood in tension. Wood, cast iron and brick in compression. Wood, steel and stone in flexure. Wire and wire rope in tension.

One afternoon per week in squads of ten during the first semester of the Junior year. (Testing Laboratory, Stratton Hall.)

9. CEMENT LABORATORY. Professor Filkins.

Natural and Portland cements. Cement mixing. Cement mortars. Testing cement and cement mortars for tensile and crushing strength; adhesion, soundness, fineness, setting, freezing, effect of chemicals.

One afternoon per week in squads of ten during the first semester of the Senior year. (Cement Laboratory, Stratton Hall.)

SECOND SEMESTER.

2. THEORETICAL MECHANICS. Professor Filkins.

Dynamics of a material point. Impact. Virtual Velocities. Centrifugal and centripetal forces. Moments of inertia of solids. Pendulums. Dynamics of rigid bodies. Work. Power. Energy. Fly-wheels. Friction. Dynamometers. Belts.

Three hours per week, the second semester of Junior year.

Course 1 in Mechanics and Construction is required.

Texts: Same as in Mechanics and Construction, Course 1.

4. GRAPHICS. Professor Filkins.

Definition. Force triangle. Force polygon. Concurrent and non-concurrent forces. Equilibrium polygons. Pole. Rays. Special equilibrium polygon. Resultant of forces. Pier reactions. Equilibrium and force polygons for vertical loads. Vertical dimensions of equilibrium polygon. Applications to simple beams with various loadings; to centers of gravity; to moments of inertia; to articulated cranes, trusses and gallows frames. Graphics of mechanisms. Forward and backward motion. Efficiency. Sliding, journal and "rolling" friction. Mill elevator. Wedge. Jack-screw. Engines. Ore-crusher. Friction Rollers. Chain friction. Tackles and pulleys. Ropes. Spur-gearing. Belting.

Lectures and recitations twice a week and drafting one afternoon a week during the second semester of the Junior year.

Course 1 in Mechanics and Construction is required.

Texts: Church's Mechanics of Engineering.

Church's Notes and Examples in Mechanics.

Howe's Roof Trusses in Wood and Steel.

DEPARTMENT OF HYDRAULICS.

Professor Hill. Assistant Professor Hazard.

1. HYDRAULICS AND HYDRAULIC MOTORS. Professor Hill.

This course is given partly by lectures, and partly by recitations; it embraces hydrostatics, the flow over weirs, through orifices, through pipes, flumes, ditches, and conduits of various forms. It also includes an elementary study of the various types of hydraulic machinery.

Five times a week for the first nine weeks of the Senior year.

Texts: Merriman's **Hydraulics and References.**

2. LABORATORY COURSE IN HYDRAULICS.

Professors Hill and Hazard.

Measurements are made of the flow over weirs, through orifices and through flumes and ditches. The determination of the approximate law of flow in pipes also forms part of the course. Water wheels are tested and the efficiency of the hydraulic ram under various conditions is determined.

Arrangements have been made by which this department is to have the use of the city's water supply for experimental work with water wheels and nozzles. This will make available a very high head (about twelve hundred feet). With the supply available for a few hours' work, tests may be made on wheels developing over three hundred-horse power.

One afternoon each week for twelve weeks of the Senior year.

DEPARTMENT OF THERMODYNAMICS AND POWER TRANSMISSION.

Professor Hill. Assistant Professor Hazard.

These courses are supplemented by visits to numerous steam, electrical and hydraulic plants in the state.

FIRST SEMESTER.

1. THERMODYNAMICS. Professor Hill.

This is a short course in the Senior year, given by lectures; it also includes the study of the steam engine indicator, injectors, etc. Lectures are also given on the methods of testing steam engines and boilers.

The course requires all of Mathematics and courses 1, 2, 3, and 4 in Physics.

SECOND SEMESTER.

2. STEAM ENGINE. Professor Hill.

This course is given mostly by recitations and includes the general description of the various classes of engines with their advantages and disadvantages.

Three times a week for one semester in the Senior year.

The course requires course 1, Thermodynamics and Power Transmission.

Text: Hutton's Mechanical Engineering of Power Plants.

4. STEAM LABORATORY. Professors Hill and Hazard.

This course includes valve setting, tests of engines, boilers, and pumps, calibration of gauges, indicator springs, etc.

One afternoon a week for twelve weeks in the Senior year.

6. POWER TRANSMISSION. Professor Hill.

This includes the transmission of power by wire rope, by compressed air, and by electricity. The course is given partly by lectures, and partly by recitations.

Five times a week for one semester in the Senior year.

Texts: Bell's Electrical Power Transmission and references.

8. ELECTRICAL LABORATORY. Professors Hill and Hazard.

Tests are made of the efficiency of motors, dynamos and transformers. The calibration of instruments is made a part of the course.

One afternoon a week for twelve weeks in the Senior year.

DEPARTMENT OF ASSAYING.

1. ASSAYING. Professor Rose.

The principles of fluxing and methods of work are taught by lectures, followed by their application in the laboratory to typical ores, silicious, barytic, pyritic, etc. The course involves thorough work in the assay of rich, medium, and low grade ores of gold, silver, and lead, and the preparation of samples.

Both the scorification and crucible methods, with silver ores, are required and the results compared. The results of assays by the nail, nitre, and roasting methods are also compared. The course includes the assay of furnace products such as mattes, slags, and bullions.

Large numbers of samples, which have been previously checked by prominent metallurgical plants in the state, are given to the students to assay. Accuracy is of first importance, and as much speed is acquired by the student as is compatible with good work.

Sophomore year, first and second semesters, one afternoon weekly.

2. ASSAYING. Professor Rose.

Special courses in assaying to students who have had the equivalent of Course 1.

DEPARTMENT OF MINING.

Professor Stockton (ad interim).

FIRST SEMESTER.

1. MINING. Professor Stockton.

This course may be outlined as follows,—hoisting, under which will be considered, motive powers, ropes, gallows-frames, receptacles and safety appliances, and pneumatic hoisting. Haulage; a discussion of the different systems of underground and surface transportation, including aerial ropeways. The drainage, ventilation and lighting of mines. Explosives, the theory of blasting, pointing and charging holes; methods of firing. Methods of breaking ground. Boring, diamond-drill work, and the percussion methods.

Lectures five times a week during the first semester of the Senior year.

Texts: Foster's Ore and Stone Mining. Ihlseng's Manual of Mining. The Coal and Metal Miner's Pocket Book.

SECOND SEMESTER.

2. MINING. Professor Stockton.

Instruction is given in methods of shaft sinking, tunneling, mine timbering and exploitation, hydraulic mining, ore deposits, mine management and the employment of labor, mine examinations, sampling of ore bodies, estimation of the "Ore in Sight," and the valuation of mining properties.

This course is supplemented by trips to mining camps for the practical and detailed study of machinery and mining methods.

Lectures, five times a week during the second semester of the Senior year.

Texts: Posepny's The Genesis of Ore Deposits. Kemp's The Ore Deposits of the United States and Canada. Bowie's A Practical Treatise on Hydraulic Mining.

4. MINING LABORATORY. Professor Stockton.

The mining laboratory time will be devoted to experimental work with explosives, construction and drawing work in connection with mine timbering and mine models, experiments with mine cars, and the making of blue prints of machinery, etc. Tests of hoisting and haulage plants will be made. This course will vary from year to year as additional apparatus and working space are provided.

DEPARTMENT OF METALLURGY.

Professor King. Professor Rose.

The study of Metallurgy begins with the Junior year and continues throughout the remainder of the school course. The subject is taught by illustrated lectures, text-books, appropriate laboratory work, and visits to metallurgical works where the students see and study the operations on a commercial scale.

Visits to the prominent metallurgical plants are of frequent occurrence during the last years of the course. These trips are required of all candidates for the Mining and Metallurgical degree. During the past two years the classes have visited the chlorination and bromination mills at Colorado City, the lead, iron, pyritic, and zinc smelters at Denver, Pueblo and Leadville, the Zinc Paint Works at Canon City and the Cyanide plants of the Cripple Creek district; also the stamp mills of Gilpin county, and many concentration and sampling works throughout the state, including the great variety of reduction works to be found in or near Denver.

On these trips the students are accompanied by the professor in charge and the visits are carefully scheduled. Many of the students work during the summer months in these plants, and though this is not required as a part of the regular course, yet the students in all the classes avail themselves of the many opportunities offered by Colorado.

FIRST SEMESTER.

1. (a) GENERAL PRINCIPLES OF METALLURGY.

Professors Rose and King.

Historical sketch. The relations of Metallurgy to Chemistry. Properties of the metals, alloys, brasses and bronzes. Thermotreatment of metals. Fuels in the solid, liquid, and gaseous state; their occurrence and manufacture.

Refractory materials, their occurrence, properties, manufacture and uses. Pyrometry and Calorimetry. Furnaces, different types used for various metallurgical operations. Blowing apparatus. Hot blast stoves. Typical metallurgical processes. Sampling of ores and metallurgical products. Roasting of gold, silver, copper, lead, zinc and iron ores.

(b) ORE DRESSING.

Three hours per week during the first semester of the Junior year.

One afternoon per week in the Laboratory.

This course requires courses 1, 2, 3, 4, 5, 6, 7, 8, 10 in Chemistry, courses 3, 5 and 6 in Mineralogy and Geology, and 1 and 2 in Assaying.

Texts and references: Roberts-Austin, **Introduction to Metallurgy.**

3. METALLURGY OF GOLD AND SILVER.

Professors King and Rose.

(a) Metallurgy of gold.

Occurrence and properties. Various processes of extraction. Stamp Milling. Extraction by amalgamation. Extraction by Chlorination. Extraction by Cyaniding. Arrangements of plants and typical mills. Melting and refining of gold and parting of gold and doré bullion.

(b) The Metallurgy of silver.

Occurrence and properties. A general discussion of various processes for the extraction from ores. The Patio process. The Washoe process. The Combination process. Chlorination roasting and pan amalgamation. The Boss process. Wet processes. Refining of silver bullion. Purchasing, sampling, and testing of gold and silver bullion.

Lectures four hours per week, and one afternoon per week in the metallurgical laboratory, during the first semester of the Senior year.

This course requires courses 1 and 2, Metallurgy.
Texts and References:

T. K. Rose, **The Metallurgy of Gold.**
Collins, **The Metallurgy of Silver.**
Eggleston, **The Metallurgy of Silver.**
Schnabel, **Hand Book of Metallurgy.**
Richards, **Stamp Milling of Gold Ores.**

SECOND SEMESTER.

2. THE METALLURGY OF COPPER.

Professors King and Rose.

Smelting in reverberatory and blast furnaces. Pyritic matte smelting. Concentration of mattes by various processes. Wet processes of treating mattes and ores. The study and calculation of furnace charges, and slags. Bessemerizing. Processes of refining in reverberatories and electrolytic refining.

Lectures three hours per week, and one afternoon per week in the metallurgical laboratory, during the second semester of the Junior year.

This course requires course 1 in Metallurgy and course 1 Assaying.

Texts and References:

Schnabel, **Hand Book of Metallurgy.**
Peters, **Modern Copper Smelting.**
Lang, **Matte Smelting.**

4. METALLURGY OF IRON, LEAD, ZINC, Etc.

Professors King and Rose.

(a) Metallurgy of iron and steel.

Ores of iron and their impurities. The metals iron and steel; their chemical and physical properties as affected by process of manufacture, and by the presence of impurities. The blast furnace. The puddling furnace. Bessemerizing. The open hearth. The crucible process. Metallography.

(b) The metallurgy of lead.

Smelting in reverberatory furnaces, in the American ore hearth and blast furnaces. Softening and refining. The Pattinson Process. The Parkes process. Cupellation.

(c) The metallurgy of zinc, tin, aluminum, mercury, antimony, and platinum.

Lectures four hours per week and one afternoon in the metallurgical laboratory, during the second semester of the Senior year.

This course requires courses 1, 2 and 3 in Metallurgy.

Texts and References:

Howe, Metallurgy of Steel.
Greenwood, Metallurgy of Iron and Steel.
Collins, Metallurgy of Lead.
Hofman, Metallurgy of Lead.
Schnabel, Handbook of Metallurgy.
Turner, Metallurgy of Iron.

ENROLLMENT OF STUDENTS.

SENIOR CLASS.

Coleman, R. Prewitt..........*City of Mexico, Mex.*
Cox, Augustus D.............*Golden, Colo.*
Devinney, George V...........*Edgewater, Colo.*
Dunkle, Fred. W..............*Indianapolis, Ind.*
Emeis, Walter H.............*Davenport, Ia.*
Emrich, Horace H............*Pueblo, Colo.*
Fleming, William L...........*Cripple Creek, Colo.*
Foster, George C..............*Chillicothe, O.*
Fry, Louis D.................*Denver, Colo.*
Funk, Walter A...............*West New Brighton, S. I., N. Y.*
Hyder, Frederick B...........*Denver, Colo.*
Izett, Glenn..................*Denver, Colo.*
King, Henry E...............*Colorado Springs, Colo.*
Liddell, Charles A............*Golden, Colo.*
Liddell, T. Parker.............*Golden, Colo.*
McDermutt, Grace C. U.......*Denver, Colo.*
McElvenny, Robert F.........*Denver, Colo.*
Merwin, Eugene W...........*Los Angeles, Cal.*
Nagel, Frank J...............*Denver, Colo.*
Palsgrove, Harry G...........*Denver, Colo.*
Parsons, H. F................*Wamego, Kas.*
Rhodes, William B............*Denver, Colo.*
Sloan, W. Arthur.............*Denver, Colo.*
Taggart, George K...........*Dallas, Tex.*
Ward, William F..............*Denver, Colo.*
Wattles, William C...........*Denver, Colo.*
Wells, Frank B...............*Los Angeles, Cal.*
Wolf, Harry J................*Golden, Colo.*

JUNIOR CLASS.

Anderson, Axel E.............*Denver, Colo.*
Carney, Hugh J...............*Ouray, Colo.*
DeSollar, Tenney C...........*Denver, Colo.*

Fillius, Lee L.	*Georgetown, Colo.*
Franck, Albert C.	*Kansas City, Mo.*
Franck, Robert P.	*Kansas City, Mo.*
Friend, Frank V.	*Deceased.*
Goodale, Stephen L.	*Colorado Springs, Colo.*
Hill, Frank C.	*Carthage, Mo.*
Johnson, L. G.	*Denver, Colo.*
Kimball, Harlow M.	*Evanston, Ill.*
Larsh, Walter S.	*Denver, Colo.*
Lee, Wallace	*Kansas City, Mo.*
Nagel, Henry P.	*Denver, Colo.*
Prier, Truman D.	*Golden, Colo.*
Robinson, George P.	*Denver, Colo.*
Sherman, Scott H.	*Denver, Colo.*
Spencer, W. Irving	*Portland, Ore.*
Tescher, Samuel	*Denver, Colo.*
Thayer, Harry Stanley	*Greeley, Colo.*
Thomas, John S.	*Denver, Colo.*
Trumbull, L. W.	*Golden, Colo.*
Vaughn, Robert M.	*Clearfield, Ia.*
Wackenhut, George J.	*Colorado Springs, Colo.*
Wallace, Howard J	*Algona, Ia.*
Washburn, H. G.	*Denver, Colo.*
Weil, Jacob	*Chicago, Ill.*
Wells, Ben T.	*Pueblo, Colo.*

SOPHOMORE CLASS.

Allen, Carl A.	*La Junta, Colo.*
Arnold, Lawrence S.	*Manchester, Engl.*
Austin, Arthur	*Denver, Colo.*
Bailey, Elbert W.	*Denver, Colo.*
Berry, Albert	*Leadville, Colo.*
Blair, E. Verne	*Springfield, Ill.*
Breeden, Roscoe D.	*Charlestown, Ill.*
Brown, Robert L.	*Denver, Colo.*
Buell, Arthur W.	*Golden, Colo.*
Busey, Alfred P., Jr.	*Pueblo, Colo.*
Carstarphen, Fred C.	*Denver, Colo.*

Chase, William C	*El Paso, Tex.*
Coffin, Roy G	*Longmont, Colo.*
Colburn, Clare L	*Denver, Colo.*
Collins, Wales S	*Denver, Colo.*
Collom, Roy Edward	*Denver, Colo.*
Cory, John J	*Denver, Colo.*
Cuno, Albert F	*Denver, Colo.*
D'Arcy, Richard L	*Denver, Colo.*
Duer, Charles L	*Denver, Colo.*
Eames, Luther B	*Pueblo, Colo.*
Filteau, Charles A	*Idaho Springs, Colo.*
Flint, Fred F	*Greeley, Colo.*
Ford, Homer D	*Denver, Colo.*
Gardner, John I	*Denver, Colo.*
Grider, Richard L	*Seiad Valley, Cal.*
Hallett, Robert L	*Denver, Colo.*
Hallett, William J	*Denver, Colo.*
Harrison, Thomas S	*Evansville, Ind.*
Haynes, Carey D	*Chicago, Ill.*
Hensley, James H., Jr	*Denver, Colo.*
Hewitt, Arthur F	*Denver, Colo.*
Hornbein, Julius	*Denver, Colo.*
Hunt, Thacher R	*Denver, Colo.*
Hyder Charles A	*Denver, Colo.*
Larison, Elden L	*Golden, Colo.*
Lee, Robert P	*Denver, Colo.*
Lennox, Luther W	*Colorado Springs, Colo.*
Lewis, Alfred F	*Manitou, Colo.*
Libby, James L	*Cheyenne, Wyo.*
Lonergan, Phillip J., Jr	*Colorado Springs, Colo.*
Lyneman, Emanuel J	*Deceased.*
Marrs, William M	*Denver, Colo.*
McCart, Robert	*Ft. Worth, Tex.*
Metcalf, Bradley B	*Denver, Colo.*
Middelkamp, Leroy L	*Pueblo, Colo.*
Muir, Douglas	*San Antonio, Tex.*
Neville, John B	*Denver, Colo.*
O'Byrne, Joseph F	*Cripple Creek, Colo.*
Oliver, Thomas C	*Charlotte, N. C.*

Paredes, Evaristo	*Culiacan, Mexico.*
Pfeiffer, Guy N	*O'Fallon, Ill.*
Pilger, Newton W	*Loup City, Neb.*
Plant, Francis B	*Covina, Cal.*
Pressler, Louis P	*Golden, Colo.*
Putnam, George B	*Denver, Colo.*
Rabb, Edward M	*Denver, Colo.*
Rath, Charles M	*Telluride, Colo.*
Reeve, Tracy	*Denver, Colo.*
Reinhard, Frank J	*Denver, Colo.*
Rice, George B	*Denver, Colo.*
Richards, Edwin R	*Montrose, Colo.*
Ryan, Will E	*Denver, Colo.*
Shiach, James W	*Houghton, Wash.*
Smith, Eric M	*Montrose, Colo.*
Spangler, Howard	*Denver, Colo.*
Spicer, Carroll A	*Colorado Springs, Colo.*
Stillman, Charles C	*Monte Vista, Colo.*
Stoeckley, Ernst F	*Canon City, Colo.*
Terrill, Arthur C	*Colorado Springs, Colo.*
Thomson, Arthur T	*Pueblo, Colo.*
Waddey, Albert Y	*Richmond, Va.*
Weems, Thomas B	*Denver, Colo.*
West, Louis C	*Evanston, Ill.*
Wright, Wm. H	*Denver, Colo.*
Zulch, Herman C	*Denver, Colo.*

FRESHMAN CLASS.

Abel, Walter D	*Denver, Colo.*
Aldrich, Harold W	*Denver, Colo.*
Allen, Maynard C	*Denver, Colo.*
Armington, Howard C	*Leadville, Colo.*
Anderson, George S	*Kearney, Neb.*
Badgley, C. W., Jr.	*Denver, Colo.*
Ball, Max W	*Golden, Colo.*
Beale, James L	*Denver, Colo.*
Bell, Charles N	*Denver, Colo.*
Brown, John B	*Topeka, Kas.*

Brown, Osborne E	*Golden, Colo.*
Brown, William E	*Greeley, Colo.*
Brunel, Rene L	*Golden, Colo.*
Chapman, Thomas	*Aspen, Colo.*
Clark, Levert L	*Washington, Ind.*
Dexter, Albert J	*Cripple Creek, Colo.*
Dietz, Walter P	*Denver, Colo.*
Dow, William G	*Denver, Colo.*
Eddy, Harold C	*Denver, Colo.*
Ellis, Thomas C	*Denver, Colo.*
Ellis, Thomas P	*Denver, Colo.*
Emens, Ray B	*Victor, Colo.*
Finigan, William H	*St. Louis, Mo.*
Freeland, William H	*Denver, Colo.*
Freidhoff, William	*Anaconda, Colo.*
Franck, Edwin L	*Canon City, Colo.*
Frank, Morton E	*Chicago, Ill.*
Gerity, Thos. C	*Denver, Colo.*
Gilbert, Arthur K	*Denver, Colo.*
Gilbert, William J	*Denver, Colo.*
Goodale, F. Augustus	*Trinidad, Colo.*
Goodell, Robert H	*South Framingham, Mass.*
Gordon, John G., Jr	*St. Louis, Mo.*
Griffiths, Guy D	*Gloucestershire, Eng.*
Hague, Harry	*Salt Lake City, Utah.*
Harkison, Chas. W	*Golden, Colo.*
Hazlehurst, Lindley M	*Winnetka, Ill.*
Heitz, George	*Denver, Colo.*
Hollis, Don D	*Silverton, Colo.*
Hughes, Gideon	*Los Angeles, Cal.*
Ingersoll, J. Curtis	*Harman, Colo.*
Isom, Edward W	*Kenilworth, Ill.*
Jackson, Orin W	*Canon City, Colo.*
Jaquette, Charles M	*Grand Junction, Colo.*
Jones, Will E	*Monte Vista, Colo.*
Kampman, E. A	*San Antonio, Tex.*
Kell, Wayne S	*Denver, Colo.*
Killgore, Thomas B	*Bloomington, Ill.*
Kleff, Marvin	*Denver, Colo.*

Koerner, Albert J.	*St. Louis, Mo.*
Ladd, Howard W.	*Ottumwa, Ia.*
Levell, Alexander	*Victor, Colo.*
Neugebauer, K. E.	*Pueblo, Colo.*
Norton, Albert C.	*La Junta, Colo.*
Nyberg, H. Edward	*Pueblo, Colo.*
Orr, Owen C.	*St. Joseph, Mo.*
Parks, George A.	*Denver, Colo.*
Philpott, Roy C.	*Cripple Creek, Colo.*
Pomeroy, Charles L.	*El Paso, Tex.*
Pope, Worden	*Denver, Colo.*
Pray, Harry G.	*Golden, Colo.*
Pusey, William J.	*Germantown, Pa.*
Ricketts, Hugh C.	*Charlestown, Ill.*
Ripley, G. Clinton	*New York City, N. Y.*
Roberts, Richard	*Boulder, Colo.*
Schlereth, C. Quinby	*Denver, Colo.*
Sebree, John P.	*La Junta, Colo.*
Shields, James C.	*Highland Park, Ill.*
Sill, Rush T.	*Colorado Springs, Colo.*
Smith, James E.	*South Pass, Wyo.*
Smith, Reuben W.	*Golden, Colo.*
Smith, Weston M.	*Edgewater, Colo.*
Stephenson, Tiffany	*Ft. Morgan, Colo.*
Stewart, Ed. M.	*Denver, Colo.*
Stotesbury, Harold W.	*Leadville, Colo.*
Thum, E. E.	*Denver, Colo.*
Vredenburg, John V.	*Jersey City, N. J.*
Warfel, Chester G.	*Golden, Colo.*
Wegeforth, C. Parker	*Chicago, Ill.*
White, J. Lansing	*Denver, Colo.*
Whitehouse, Howard D.	*Denver, Colo.*
Zeiger, Robert L.	*Pueblo, Colo.*

STUDENTS, 1902-1903.

Seniors	28
Juniors	28
Sophomores	76
Freshmen	82
Total	214

SUMMARY BY STATES AND COUNTRIES.

Colorado	152	New York	2
Illinois	14	Wyoming	2
Missouri	8	Massachusetts	1
Texas	6	New Jersey	1
Iowa	5	North Carolina	1
California	5	Ohio	1
Indiana	3	Oregon	1
England	2	Pennsylvania	1
Kansas	2	Utah	1
Mexico	2	Virginia	1
Nebraska	2	Washington	1

From Colorado, seventy-one per cent. All others, twenty-nine per cent.

REGISTER OF THE ALUMNI BY CLASSES.

1883.

Middleton, Wm. B................................*Denver, Colo.*
Mining Engineer.

Wiley, Walter H...........................*Idaho Springs, Colo.*
Mining Engineer.

1886.

van Diest, Edmund C...........................*San Luis, Colo.*
Superintendent Maxwell Land Grant.

Gehrmann, Chas. A.........................*Idaho Springs, Colo.*
Superintendent Consolidated Stanley Mining Co.

1888.

Ambrosius, Carl E.....................*Guanacevi, Durango, Mex.*
Mining Engineer.

*Floyd, John A................

*Kingman, Jerry...............

*Lorah, Bela I.................

1889.

Bellam, Henry L...............................*Anaconda, Mont.*
Chemist, Anaconda Mining Co.

Craigue, Wm. H.........................*Colorado Springs, Colo.*
Mining Engineer.

*Wertheim-Salomonson, F. M. G. A.

1890.

Comstock, Chas. W..................*Boston Bldg., Denver, Colo.*
Civil and Mining Engineer, Engineering Co. of America.

1891.

Johnson, Edward W.............................*Murray, Utah.*
Assistant Superintendent Murray Plant, Am. S. & Ref. Co.

Smith, Chas. D...........................*Atacama, Peru, S. A.*
Metallurgist.

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*Deceased.

1892.

Aller, Frank B. .... *Peru, S. A.*
Metallurgist with M. Guggenheim.

Brown, Norton H. .... *Denver, Colo.*
Surveyor General's Office.

Budrow, Wm. B. .... *Pueblo, Colo.*
Assistant Superintendent, Philadelphia Smelter.

Cole, Burt .... *Los Angeles, Cal.*
Engineer.

Hindry, Willis E. .... *El Oro, Mexico*
Superintendent, Esperanza Mine.

Kimball, Geo. K., Jr. .... *Idaho Springs, Colo.*
Superintendent, Old Town Mining Co.

Kimball, Jos. S. .... *Golden, Colo.*

Lewis, Wm. B. .... *Denver, Colo.*
Manager, Denver Sulphite Fibre Co.

McMahon, Chas. H. .... *Sombrerete, Zacatecas, Mexico*
General Superintendent, Sombrerete Mining Co.

1893.

Collins, Phillip M. .... *Colorado City, Colo.*
Superintendent, Portland Mill.

Hawley, R. Howard .... *Monterey, Mexico*
Chemist, National Mex. Smelting Co.

Jewell, Gilbert E. .... *Chartres Towers, Queensland, Australia*
Metallurgist.

Milliken, Wm. B. .... *Deadwood, S. Dak.*
Mining Engineer.

Osborne, Arthur H. .... *Georgetown, Colo.*
Surveyor.

Stephens, Wallace A. .... *Denver, Colo.*
Metallurgist.

1894.

Atkins, Horace H. .... *711 17th Ave., Denver, Colo.*
Assayer, Grant Plant American S. & R. Co.

Bowie, Jas. W..............................*Gallup, New Mex.*
Mine Superintendent, Caledonia Coal Co.

Post, George M................ *1030 W. 14th Ave., Denver, Colo.*
Lawyer.

Saint Dizier, Julius L...................*San Luis Potosi, Mexico*
Engineer, Compania Metalurgica Mexicana.

Schneider, Geo. W..........................*Central City, Colo.*
Deputy Commissioner of Mines.

Wheeler, Chas. E...........................*Lampazos, Mexico*

1895.

Arthur, Ed. P..............................*Cripple Creek, Colo.*
Mining Engineer and U. S. Deputy Mining Surveyor.

Davis, Carl R..................................*Rossland, B. C.*
Superintendent, War Eagle and Central Star M. Co.

Dockery, Love Atkins.......................*Chihuahua, Mexico*
Ashton & Dockery, Mining Engineers.

Durell, Chas. T....................*Gilt Edge, Fergus Co., Mont.*
Manager Central Montana Mines Co.

Eaton, Albert L...............................*Leadville, Colo.*
Assayer, Penn M. & L. Co.

Eye, Clyde M.................................*Georgetown, Cal.*
Superintendent and Local Manager, Alpine Mine

Field, Fred M.................. . *Pony, Montana*
Metallurgist (Cyanide).

Gray, Latimer D..........................*Rock Springs, Wyo.*
Electrical Engineer, Union Pacific Coal Co.

Hartzell, Lester J...............*729 W. Quartz St., Butte, Mont.*
Assayer Butte & Boston Smelter.

Kennedy, Geo. A...............*2709 Boulevard F., Denver, Colo.*
Mining Engineer.

Limbach, Edmund C..........................*Gilt Edge, Mont.*
Surveyor, Central Montana Mines Co.

Maxwell, Fred A. G............*Randfontein, Transvaal, S. Africa*
Metallurgist, Porges Randfontein G. M. Co.

Merryman, Herbert E......................*Cripple Creek, Colo.*
Surveyor.

Parker, Jas. H.................................*New York, N. Y.*
Student, Columbia University.

Rowe, Edmund E..............................*Denver, Colo.*
Manufacturer, E. E. Rowe & Co., Pressed Brick.

*Shetler, Waverly..............

Skinner, Lewis B.......................*Colorado Springs, Colo.*
Superintendent, Standard Mill, Colo.-Phila. Reduction Co.

Stannard, Burt C................................*Everett, Wash.*
Chemist, Puget Sound Reduction Co.

Stockton, Robt. S..............................*Golden, Colo.*
Professor of Mathematics and Surveying, Colo. School of Mines.

Suhr, Otto B..........................*Niagara Falls, Ontario*
General Superintendent, Niagara Falls Power Co.

Titsworth, Frederick S..........................*Denver, Colo.*
Engineer, 207 Boston Building.

Wallace, Lewis R...............................*Morenci, Ariz.*
Superintendent, Detroit Copper Co.

Young, Frank B...............................*Gilt Edge, Mont.*
Superintendent, Central Montana Mines Co.

1896.

Atkinson, Walter J..............................*Chicago, Ill.*
Civil Engineer.

Barensheer, Wm. J.............*Taylor and Bert Sts, Denver, Colo.*
Assayer.

Barnes, Corrin.................*325 Xenia St., Cripple Creek, Colo.*
Assayer and Chemist.

Beeler, Henry C................................*Cheyenne, Wyo.*
Wyoming State Geologist.

Dwelle, Jesse E...................*1716 Blake St., Denver, Colo.*
Chemist, Gold & Silver Extraction Co., Ltd.

Griswold, Geo. G.....................*1260 Race St., Denver, Colo.*
Chemist, Globe Smelter.

Hoyt, Geo. F...........................*Mapimi, Durango, Mexico*
Assistant Superintendent, Smelter Minera de Penoles.

Maynard, Rea E...................*Honolulu, Hawaiian Islands*

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*Deceased.

Mitchell, Geo. B.................*67 Dubord St., Montreal, Canada*
Assistant Engineer, Canadian Pacific Railway.

Milliken, John T...........................*Deadwood, S. Dak.*
Imp. M. & M. Co.

Nance, Wm. H.................................*St. Louis, Mo.*
St. Louis Smelting & Refining Co.

Newnam, Wm. E.................................*Omaha, Neb.*
Chemist, Omaha & Grant Smelter.

Paul, Wm. H.............................*Central City, Colo.*
Manager, Mammoth Gold Mining Co.

Strout, Fred McL........................*Cripple Creek, Colo.*
Assayer, Stratton's Mines (Strout & Son).

1897.

Buck, Arthur H....................*Miniaca, Chihuahua, Mexico*
Engineer, Sunset Mining Co.

Bussey, Edwin E...............................*Denver, Colo.*

Canning, Herbert A.............................*Aspen, Colo.*
Deputy Commissioner of Mines.

Cohen, Louis......................*Sombrerete, Zacatecas, Mexico*
Assayer, Sombrerete Mining Co.

Draper, Marshall D..................*Barth Block, Denver, Colo.*
American Exploitation Co.

Febles, John C..................................*Butte, Mont.*
Anaconda Copper Co.

Gross, John................................*Deadwood, S. Dak.*
Engineer, Penobscot Mining Co.

Hazard, W. J....................................*Golden, Colo.*
Ast. Professor in Physics and Descriptive Geometry, Colo. School of Mines.

Jarvis, R. P............................*Torreon, Coah., Mexico*
Compania Metallurgica de Torreon, S. A.

Kelley, W. A....................................*Denver, Colo.*
Chemist, McArthur-Forest Co.

Lerchen, F. H..............*Modoc, Dona Anna Co., New Mexico*
Superintendent of the Modoc M. Co. and the Torpedo M. Co.

Logue, N. W.....................................*Aspen, Colo.*

McLeod, J. Norman........................*Black Hawk, Colo.*
Miners Ore Sampling Co.

McGregor, Geo. H...........................*Central City, Colo.*
Superintendent of Mines for Rocky Mt. G. & M. Co.

Nelson, H. E....................*711 Fifth Ave., Spokane, Wash.*
Engineer for Bradley Eng. & Mach. Co.

Nye, Robert...............................*Placerville, Idaho*
Manager of the Moline Mining Co.

Powell, Geo. F.................*Santa Isabel, Chihuahua, Mexico*
Superintendent, Magistral Mine.

Roller, Arthur H.........................*Idaho Springs, Colo.*
Superintendent, Shafter Mining Co.

Schumann, Enrique A..........

Starbird, H. B..................................*Victor, Calif.*
Lessee, Rose Mine.

Warnecke, Carl M..............................*Sherman, Cal.*
Chief Electrician, Los Angeles-Pac. Railway Co.

Weed, Floyd..................................*Kimberly, Utah*
Care Annie Laurie Mine.

Woods, Thos. H.................................*Ouray, Colo.*
Superintendent, Camp Bird Mill.

1898.

Barbour, Percy P.........................*Idaho Springs, Colo.*
Surveyor of Stephens & Barbour.

Bertschy, Perry H.............................*Gilt Edge, Mont.*
Chemist, Great Northern M. & D. Co.

Blumenthal, Emil E........................*Philipsburg, Mont.*
Chemist, with the Grant Bi-metallic Cons. Mining Co.

Caldwell, Florence H..............................*Denver, Colo.*

Church, Myron J...............*Ojuela, Mapimi, Durango, Mexico*

Clark, Winfred N.................................*Victor, Colo.*
Electrical Engineer, with Pike's Peak Power Co.

Corry, Arthur V..................................*Butte, Mont.*
Manager, Mont d' Or Mine.

Davey, Wm. R.................................*Lake City, Colo.*
Assayer.

Dollison, Jas. E...................................*Alma, Colo.*
Assayer.

Hamilton, Frank R.................................*Ouray, Colo.*
Assayer with "Camp Bird" Mine.

Harrington, Orville................*1650 Grant Ave., Denver, Colo.*

Ingols, J. August..........................*Idaho Springs, Colo.*
Surveyor.

Johnson, Fred.......................*Torreon, Coahuila, Mexico*
Chemist, Campania Metallurgica de Torreon, S. A.

Jones, Frank H..................................*Denver, Colo.*
Surveyor C. F. & I. Co.

Kraemer, Edw. L..............................*Shanghai, China*
Care H. Mandl & Co.

Lampe, Oscar A...............................*Parral, Mexico*
Assayer.

Lucy, Richard W..............*Room 5 Union Depot, Pueblo, Colo.*
Surveyor with D. & R. G. Railway.

Magenau, Wm.............................*Fredericktown, Mo.*
Superintendent, Catherine Lead Co.

Norman, Jno. Edw......*302 Mining Exchange Bldg., Denver, Colo.*
Mining Engineer.

Rodriguez, J. Crisostomo.......................*Saltillo, Mexico*
Mining Superintendent.

Smith, Harry C...................*1046 Corona St., Denver, Colo.*

Stephens, Chas. N...............................*Denver, Colo.*
Draftsman for Colorado Telephone Co.

Valentine, Malvern R............................*Victor, Colo.*
Manager of the Taylor & Brunton Sampler.

Whitaker, Orvil R.....................*San Juancito, Honduras*
Superintendent, New York & Honduras Rosario Mining Co.

1899.

Adami, Chas. J...........................*Box 612 Butte, Mont.*
Engineer for the Anaconda G. M. Co.

Bruce, Stuart S.............................*Leadville, Colo.*
With the Arkansas Valley Smelter.

Cramer, Curtis P..........................*Tierro, New Mexico*
Assayer for Gilchrist & Dawson Co.

Davis, Gilbert L................*Room 7 Evans Blk., Denver, Colo.*
Assistant Engineer with Denver Tramway Co.

Grant, Lester S..........*214 W. Eaton Ave., Cripple Creek, Colo.*
With the Isabella Gold Mining Co.

Hodgson, Arthur...................................*Denver, Colo.*
Assayer for the Denver Mint.

Johnson, Gilbert...................................*Kennett, Cal.*
Engineer with the Trinity Copper Co.

Kelley, Fred G...........................*Black Hawk, Colo.*
Surveyor of the Cook Mining Co.

Muir, David.......................................*Kennett, Cal.*
Engineer with the Trinity Copper Co.

Rising, Arthur F.................*79 Water St., Perthamboy, N. J.*
Chemist for the Delamar Copper works.

Royer, Frank W................*4003 W. 35th Ave., Denver, Colo.*
Mining Engineer.

Smith, Thos. G....................................*Denver, Colo.*
Assistant Supt., Grant Plant American Sm. & Ref. Co.

Steinhauer, Fred C...........................*Tabasco, Colo.*
Superintendent of the Tabasco Mine of the C. F. & I. Co.

Thompson, Jas. S................................*Sopris, Colo.*
Superintendent of the C. F. & I. Co. Mines.

Townsend, Arthur R...........*117 East 57th St., New York City*
Mining Engineer.

Tyler, Sydney B.........*Panuco de Coronado, Durango, Mexico*
Surveyor with the San Luis Mining Co.

Waltman, Will D. ......*214 E. Kiowa St., Colorado Springs, Colo.*
Assistant City Engineer.

Weiss, Andrew...................................*Golden, Colo.*
Ass't Prof. in Mathematics and Surveying in the Colo. S. of M.

Williams, Wakely A.............*Grand Forks, British Columbia*
Assistant Superintendent, Granby Cons. M. & Sml. Co.

1900.

Adams, Wilber E..............*36 Adams Block, Lewiston, Idaho*
Mining Engineer.

Benwell, Geo. A..................*205 Century Bldg., Denver, Colo.*
Mining Engineer.

Bruce, Harry F.......................*Thunder Mountain, Idaho*

Crowe, Thos. B...........................*Cripple Creek, Colo.*
Assistant Manager, Gold Exploration Co.

Drescher, Frank M..............................*Clifton, Ariz.*
With the Valverd Copper Mine.

Evans, Henry R.................................*Reno, Nevada*
U. S. Government Survey.

Ewing, Chas. R................................*Atlanta, Idaho*
With the Atlanta Mines.

Giddings, Donald S...........................*Morenci, Ariz.*
Assistant Surveyor with the Detroit Copper Mining Co.

Harrington, Daniel...........................*Sunnyside, Utah*
With the Pleasant Valley Coal Co.

Jones, Edward B......................*Box 1332, Denver, Colo.*
Mining Engineer.

Jones, Fred......................*Box 818, Cripple Creek, Colo.*
Engineer, Stratton Consolidated Mines.

Lemke, Carl..................................*Silverton, Colo.*
With the "Grand Mogul" Mine.

Malmstrom, Clarence C........*400 Main St., Cripple Creek, Colo.*
Assayer for Stratton's Mines.

Moynahan, Ambrose E..........................*Alma, Colo.*

Nicolson, Geo. W.......................*Box 304, Silverton, Colo.*
With the "Contention" Mining Co.

Pendery, John M.............................*Leadville, Colo.*

Platt, Edwin H...............................*Denver, Colo.*
Denver Engineering Works.

Price, Lyttleton, Jr...............................*Boise, Idaho*
In Surveyor General's Office.

Prout, Jno..............*Fredrickstown, St. Francis Co., Missouri*
With Columbia Lead Co.

Robey, Lloyd..................................*Telluride, Colo.*
With the "Liberty Bell' Mine.

Rudd, Arthur H.... .*522 Mining Exchange Bldg., Denver, Colo.*
Surveyor.

Slater, Amos.....................*408 Boston Bldg., Denver, Colo.*
Assistant Geologist with the C. F. & I. Co.

*Smith, Claude H..............

Steele, Jas. H...................................*Denver, Colo.*
Instructor in Mathematics and Drafting in the M. T. H. S.

Taylor, Henry Picotte.......................*Tuscarora, Nevada*
General Manager of the Leonard Taylor Mining Co.

Utley, Howard Harris.......*415 W. Jefferson St., Louisville, Ky.*
Engineer with the North Jellico Coal Co., Taylor Coal Co. and Williams Coal Co.

1901.

Atwater, Maxwell W...................*Box 573, Telluride, Colo.*
With the "Liberty Bell" Gold Mining Co.

*Bishop, Raymond.............

Bowman, Frank C...........................*Central City, Colo.*
With Cyclops Assay Office.

Bradley, Joseph M........................*Box 778, Florence, Colo.*

Breed, Chas. Francis.............*817 Boston Bldg., Denver, Colo.*
With the C. F. & I. Co.

Brinker, Arthur C..............*1736 Lawrence St., Denver, Colo.*
With E. E. Burlingame, Assayer.

Bruce, Jas. L..................................*Cripple Creek, Colo.*
Surveyor with Hills & Willis.

Bumsted, Edward L................*Box 336, Guayaquil, Equador*
With the South America Development Co.

Burlingame, Walter E...........*1736 Lawrence St., Denver, Colo.*
Chemist and Assayer with E. E. Burlingame & Co.

Chandler, John Winthrop, Jr.......*122 Twelfth St., Oakland, Cal.*

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*Deceased.

Clark, George B.......... *573 S. Washington Ave., Denver, Colo.*
Engineer.

Collins, Shrive B..........*Box 94, Amethyst P. O., Creede, Colo.*

*Crow, Wade L................

DeCou, Ralph E........ *Table Mountain, Mammoth P. O., Ariz.*
With the Table Mountain Copper Co.

Downer, Roger H....................................*Engineer.*
Care of A. Chester Beatty, 523 McPhee Bldg., Denver, Colo.

Ehle, Mark, Jr...........................*Rapid City, S. Dak.*
Professor of Engineering in the S. Dakota School of Mines.

Frank, Harry L......................*Dedrick, Trinity Co., Cal.*
Engineer, Trinity Co. Gold Mining Co.

Harris, Willard F................................*Ouray, Colo.*
With the "Camp Bird" Mine.

Jackson, Walter H......................*San Juancito, Honduras*
Engineer, New York & Honduras Rosario Mining Co.

Johnson, Junius W................*1038 Penn. Ave., Denver, Colo.*
Surveyor for Denver & Northwestern Railway.

Lewis, Frank E....................*1224 Stout St., Denver, Colo.*
Surveyor with the Colorado Telephone Co.

Lovering, Ira G...............................*Jamestown, Colo.*
Assayer with the Longfellow Mine.

Lucy, Frank Allen..........................*Idaho Springs, Colo.*

McDaniel, Alexander K...........................*Butte, Mont.*
Engineer for Boston & Montana Cons. C. & S. Mining Co.

Marrs, George Oliver...........................*Golden, Colo.*
Assistant Superintendent, Carpenter Smelter.

May, John G........................*Velardina, Durango, Mexico*
With the Velardina Mining & Smelting Co.

Millard, Frank W......................*Box 595, Telluride, Colo.*
Engineer with the "Ella" Gold Mining Co.

Parrish, Karl C...............................*Tuolumne, Cal.*
Superintendent, New Era Mining Co.

Pray, Winfred A.............................*Georgetown, Colo.*
Surveyor with F. A. Maxwell, U. S. Deputy Mineral Surveyor.

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*Deceased.

Sale, Andrew J....................*2312 Marion St., Denver, Colo.*

Scheble, Max C...........................*Rock Springs, Wyo.*
Surveyor with the Union Pacific Coal Co.

Simpson, William P............................*Monterrey, Mexico*
Head Assayer with "Monterey Plant" A. S. & R. Co.

Small, Harvey B...............*Ojuela, State of Durango, Mexico*
Engineer with the Compania Minera de Penoles.

Starbird, Edwin P............................*Victor, California*
Superintendent of Rose Mine and Mill.

Street, Gerald B..........*56 W. Fourth So. St., Salt Lake, Utah*
With the Samuel Newhouse Co.

Watson, Hugh C........................*San Juancito, Honduras*
Engineer, New York & Honduras Rosario Mining Co.

Williams, Fred Tuttle...............................*Victor, Colo.*
Surveyor with Portland G. M. Co.

1902.

Anderson, Neil A.................................*Union, Idaho*

Badger, Herbert E..............................*Greeley, Colo.*

Barron, Chauncey T.............................*El Paso, Texas*

Bergh, John Evans..............................*Bingham, Utah*
Care Dalton & Lark.

Bucher, John William................*Ely, White Pine Co. Nevada*
Chemist and Surveyor with New York & Nevada Copper Co.

Butler, G. Montague................*Box 448, Idaho Springs, Colo.*
Engineer with "Big 40" Tunnel Co.

Charles, Lavern J...............................*Montrose, Colo.*
With the U. S. Geological Survey of the Gunnison Tunnel.

Christensen, Walter...............................*Mercur, Utah*
With the Mercur Cons. Mining Co.

Collbran, Arthur Harry...........................*Seoul, Korea*

Cox, W. Ray.....................................*Denver, Colo.*
Draftsman with Denver Tramway Co., Evans Blk., Denver, Colo.

Ehrich, Walter L............*320 Sansome St., San Francisco, Cal.*
Mining Engineer.

Ellis, William Witty.............................*Victor, Colo.*
Assayer with Taylor & Brunton Sampler.

Estes, Frank M., Jr......................*Kelner, Boone Co., Ark.*
Draughtsman with the Missouri Pacific Railroad.

Ickis, Harry M...................................*Creston, Iowa*

Lehmer, Frank Welton.........*1160 Sherman Ave., Denver, Colo.*
Engineer, National Development Co.

Montrose, James Fay..............................*Lead, S. Dak.*
Assayer with "Hidden Fortune."

Moss, Cleveland Osgood..................*Box 1832, Denver, Colo.*
With the Utah Fuel Co.

Paul, Russell B..........................*Box 596, Denver, Colo.*
Surveyor in Idaho Springs, Colo.

Powers, Oliver...................................*Telluride, Colo.*
With the "Telluride Power Transmission Co."

Reno, Horace Thornton............................*Arvada, Colo.*

Richards, John V.................*1725 First Ave., Spokane, Wash.*
With Standard Mining Co., Mace, Idaho.

Rowe, Charles Elmer..........
Mining and Civil Engineer for Victor Fuel Co., Hastings, Colo.

Storm, Lynn W...................................*Salt Lake City*
Engineer National Development Co.

Watts, Alfred C...................*817 Boston Bldg., Denver, Colo.*
With the C. F. & I. Co.

ALUMNI.

The record of the graduates, as a body, is perhaps the most gratifying feature in the history of the Colorado School of Mines. Numbering at present over two hundred, and occupying, as most of them do, positions demanding skill and responsibility, they form the best evidence that the institution has its place among technical schools of the first rank.

THE ALUMNI ASSOCIATION.

The Association of the Alumni of the Colorado School of Mines was organized by the class of 1895, and the first banquet held at the Windsor Hotel in Denver on June 7th, 1895.

The association holds its annual reunion and banquet on the day following the commencement exercises, unless otherwise provided by the Executive Committee.

The graduates of the school are cordially urged to join the association and attend the reunions when possible. It is worth considerable to you and to the school to keep in close touch and to cultivate and maintain the feeling of loyalty which should always exist between the graduate and his old school. In this connection it is well to remind every Alumnus to keep the secretary of the association informed in regard to his address and occupation.

The aim of the Alumni Association is to promote acquaintance and friendship among the graduates, to encourage them to aid each other, and to make an organized effort to elevate and uphold the reputation and standard of the Alma Mater.

The presidents of the Association in order, have been Wm. B. Middleton '83, W. B. Milliken '93, E. E. Rowe '95, C. W. Comstock '90, and Edward P. Arthur, Jr., '95.

OFFICERS OF THE ASSOCIATION

For the Year Ending June 1st, 1903:

PRESIDENT—Arthur R. Hodgson '99.
VICE-PRESIDENT—Frederick S. Titsworth '95.
SECRETARY—Robert S. Stockton '95.
TREASURER—Wm. J. Hazard '97.

EXECUTIVE COMMITTEE.......	M. D. Draper '97. Chas. J. Adami '99. Robert Nye '97

STANDING COMMITTEES.

COMMITTEE ON ATHLETICS...	James S. Thompson '99. Amos Slater '00. A. H. Roller '97 O. R. Whitaker '98. H. A. Canning '97.
COMMITTEE ON INSTRUCTION	Edward P. Arthur, Jr., '95 Thos. G. Smith, '99. Edward E. Rowe '95. J. E. Dwelle '96. Lyttleton Price '00.
COMMITTEE ON NOMINATIONS	Andrew Weiss '99. Henry C. Beeler, 96. J. N. McLeod '97. E. H. Platt '00. M. C. Scheble '01.

APPENDIX.

LECTURES.

In certain lines, there are given to the older classes extra lectures on special subjects.

Law. The lectures on the relation of law to mining are given by some prominent member of the bar, and cover many of the main points of mining and corporation practice.

Mining, Milling and Metallurgy. Several lectures (sampling), have been given by Mr. Henry Vezin (recently deceased). Others on crushing, cyaniding, etc., have been secured from the well known mining and metallurgical expert, Mr. Philip Argall. These lectures add greatly to the course, not only in interest, but also in practical value, coming as they do in a timely way from those who are actively engaged in the profession.

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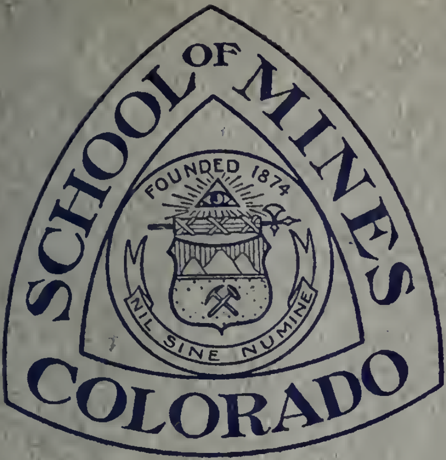

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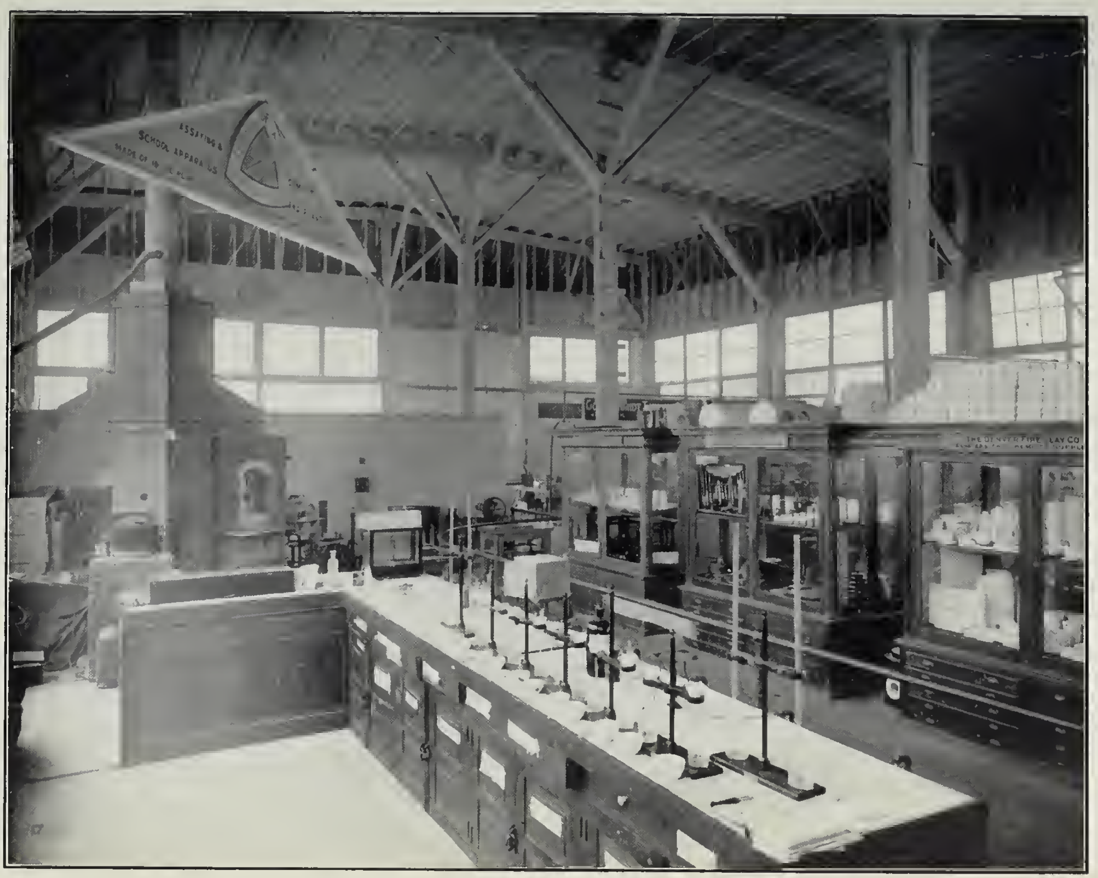

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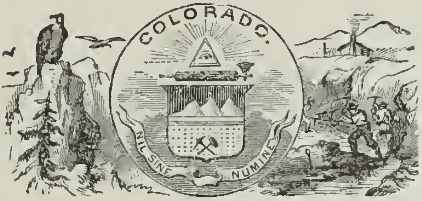

GOLDEN, COLORADO.
1904-1905.
B.S.

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COLLEGE CALENDAR.

1904.

August	31	Wednesday	Second Examinations for Entrance to the Class of 1908, and Re-examination of Matriculated Students.
September	1	Thursday	
September	2	Friday	
September	6	Tuesday	Opening of the First Semester of the Academic Year, 1904-5.
November	24	Thursday	Thanksgiving Recess.
November	25	Friday	
December	22	Thursday	Christmas Recess Begins.

1905.

January	3	Tuesday	Christmas Recess Ends.
January	20	Friday	First Semester Ends.
January	23	Monday	Second Semester Begins.
February	22	Wednesday	Washington's Birthday. (A holiday.)
May	26	Friday	Second Semester Ends. Commencement Exercises.
May	29	Monday	Field Surveying Begins.
May	29	Monday	First Examinations for Entrance to Class of 1909.
May	30	Tuesday	
May	31	Wednesday	
June	23	Friday	Field Surveying Ends.
August	30	Wednesday	Second Examinations for Entrance to the Class of 1909, and Re-examination of Matriculated Students.
August	31	Thursday	
September	1	Friday	
September	5	Tuesday	Opening of the First Semester of the Academic Year 1905-06.

BOARD OF TRUSTEES.

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Term expires, 1907.
Secretary,
JAMES T. SMITH, Denver, Colo.
Term expires, 1905.

OTTO F. THUM, Denver, Colo.
Term expires, 1905.

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Term expires, 1907.

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Term expires, 1907.
Treasurer,
JESSE W. RUBEY, Woods-Rubey National Bank, Golden, Colo.

The regular meetings of the Board of Trustees are held in Golden, at the School of Mines, on the second Thursday of each month.

FACULTY.

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President.

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GURDON MONTAGUE BUTLER, E. M.,
Instructor in Geology and Mineralogy.

JOHN JOSEPH BROWNE, B. A.,
Instructor in Mathematics.

WILLIAM FRANKLIN ALLISON, B. S., C. E.,
Instructor in Surveying.

STEVE HOWARD WORRELL, B. S.,
Instructor in Quantitative Analysis.

GYULA BENNETT MANSON, S. B.,
Instructor in Descriptive Geometry and Drawing.

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Registrar.

MABEL CLAIRE SHRUM, B. L. S.,
Librarian.

AGNES ESTELLE PRESNELL,
Secretary to the President.

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Professors Burger, Wolcott, and Mr. Bailar.

Catalogue,
Professor Fleck, Mr. Eggleston, and Mr. Browne.

Buildings and Grounds,
Professors Curtis, Patton, and Mr. Allison.

Library,
Professors Young, Curtis, and Miss Shrum.

Athletics,
Professors Patton, Fleck, and Mr. Haldane.

Theses,
Professors Traphagen, Filkins, and Young.

Bulletin,
Professor Filkins and Mr. Butler.

Student Societies,
Professors Hazard, Young, and Mr. Eggleston.

The President is *ex officio* a member of all committees.

SPECIAL LECTURERS.

DR CHARLES R. VAN HISE, Ph. D., LL. D., Madison, Wis.,
President of the University of Wisconsin,
The Qualities that make Seniors.

GEN. O. O. HOWARD, U. S. A. (Retired), Burlington, Vt.,
Character.

DR. JAMES REID, A. M., D. D., Bozeman, Mont.,
President of the Montana State College,
The Mistakes of a Freshman.

MR. C. J. MOORE, Denver, Colo.,
Mining Engineer,
Geology Applied to Mining.

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Dean of the Law School, University of Colorado,
Mining Law.

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Colorado College,
Starting Aright.

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Industrial Cars.

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Associate Editor of Mines and Minerals,
The Colorado Coal Deposits (Illustrated.)

MR. E. BARTON HACK, E. M., Denver, Colo.,
Mining Engineer,
The Calgoorie and Coolgardie Gold Fields of West Australia.

MR. C. O. POOLE, E. E., Denver, Colo.,
Electrical Engineer for Hendrie and Bolthoff,
The High Tension Transmission Lines of California (Illustrated).

MR. W. G. SWART, Denver, Colo.,
The Blake Electrical Separator.

MR. JAMES UNDERHILL, E. M., Idaho Springs, Colo.,
The General Land Office and Patent Surveys.

HISTORY, ORGANIZATION, FINANCIAL SUPPORT, AND LOCATION.

HISTORY.

The Colorado School of Mines was established by an act of the Territorial Legislature, approved February 9, 1874. After an unsatisfactory experience in temporary quarters the School was permanently housed in the original "building of 1880," upon land given by the citizens of Golden. Since then the School has enjoyed a strong and steady growth in buildings, in equipment, in students, in Faculty, and in the strength and rigor of its courses. Additions were made to the original building of 1880, by the building of 1882, and by the building of 1890. Engineering Hall was erected in 1894, the Stratton Assaying Laboratory in 1900, and the new hall for Mining and Metallurgy, called Stratton Hall, was completed in 1904.

ORGANIZATION.

The corporate name of the institution by statute is "The School of Mines." The general management of the Colorado School of Mines is vested by statute in a Board of Trustees, consisting of five members appointed by the Governor of the State with the advice and consent of the Senate. The members of the Board of Trustees are appointed in alternating sets of two and three, and hold their office for a period of four years and until their successors are appointed and qualified. The Board of Trustees elect one of their number President. They also appoint a Secretary and Treasurer either from their own number, or from other suitable persons as they may deem best. Any three of said Board of Trustees constitute a quorum for the transaction of business. The President of the Faculty of the School, who shall be appointed by the said Board of Trustees, shall be known as "President of the School of Mines." By the organic Constitution of Colorado, the School of Mines is regarded as an Institution of the State.

FINANCIAL SUPPORT.

The Colorado School of Mines is supported by the income derived from the annual tax of one-fifth of a mill on each dollar of the assessed property of the State, and this is known as the "School of Mines Tax." In addition to this the Legislature has from time to time provided by special appropriation for such emergency funds as the means of the State treasury and the necessities of the School might suggest.

LOCATION.

The Colorado School of Mines is in the south central part of the city of Golden, Jefferson County. Golden is about fifteen miles from Denver, and can be reached by the Colorado and Southern Railroad from the Union Station at the foot of Seventeenth Street, by the Denver and Intermountain Railway, from the Arapahoe Street Station, between Fourteenth and Fifteenth Streets, or by the Denver and Northwestern Railway, from the Loop on Sixteenth Street, between Arapahoe and Lawrence Streets, Denver.

Golden has about three thousand inhabitants and is one of the oldest cities in Colorado. When the Colorado School of Mines was located there the city was one of the most important smelting centers of the State, and its selection as a permanent home for the school was both natural and appropriate. Subsequently the business and the population of Golden suffered by the removal of the smelters and their concentration at Denver; but recently the city has awakened to a new birth of activity and anticipation, due to its certain development into a residence town such as usually clusters around a college, which promise is strengthened by the fact that Golden is the most available mountain or foot-hill home suburban to and available from Denver.

Golden has one bank, many churches, a fine public school system, two weekly newspapers, several elevators, a smelter, brick works and other lines of business, and altogether is a thriving, prosperous, growing city, an ideal home for a great school of mines. The peculiar grouping of the neighboring hills is such as to combine the practical and the picturesque—freedom and isolation. The altitude of Golden is five thousand seven hundred feet above sea level, or about four hundred and fifty feet higher than Denver. The town lies close to the first foot-hills of the Rocky Mountains, but can hardly be regarded as a "mountain town," though within an hour's ride by rail of some of the well-known mining camps of the region. No place in Colorado has a better health record than Golden. The climate is invigorating and pleasant, with open winters and a large proportion of clear days. The surrounding region is rich in the characteristic scenery of the Rocky Mountain region.

The Colorado School of Mines is peculiarly well located to give students both a theoretical and practical training. The equipment of the school enables the theoretical side to be well presented. The nearness to mines, mills, and smelters offers unusual opportunities for inspection visits, and enables the student to see in actual operation every variety of mining and metallurgical work. The Independent Pyritic Smelter is located at Golden. In the Clear Creek canon are the numerous gold mills and concentrators of Gilpin and Clear Creek counties. At Argo, near Denver, the Boston and Colorado Smelting Company illustrates the metallurgy of gold, silver, and copper ores. At the Globe plant of the American Smelting and Refining Company the treatment of lead ores and dry ores of gold and silver is illustrated by up-to-date methods. At Denver also are the Colorado Zinc Works, using the most modern methods of magnetic and electric separation, and in addition there are numerous sampling and ore testing works. The many mining and metallurgical machinery plants of Denver also afford an excellent opportunity for becoming acquainted with recent improvements in metallurgical design. At Colorado City are the Portland, Standard, and Telluride mills for the chlorination treatment of gold ores; at Cripple Creek, the Cripple Creek and Homestake mills; and at Florence, the Union and Dorcas mills. The plant of the Colorado Fuel and Iron Company at Pueblo possesses all the recently invented and approved devices for the production of iron and steel and for working these products into marketable forms. At Pueblo there are also three lead smelters, the Pueblo, Eilers and Philadelphia, and the Zinc Smelter of the Colorado Zinc Company. At Canon City are the plants of the Empire

Zinc Company and of the United States Reduction and Refining Company, and at Leadville, the Arkansas Valley Smelter. The Black Hills, where good practice in gold milling and cyanidation is to be found, and the great copper smelters of Montana, are also visited in longer trips.

At or near Golden are numerous clay mines and quarries and extensive coal mines well equipped with hoisting and power machinery. In the Clear Creek canon, within a short ride of Golden, are the mining camps of Central City, Black Hawk, Idaho Springs and Georgetown, and placer mining at Breckenridge. The well-known mining camps of Cripple Creek, Victor, Leadville and Aspen, as well as the San Juan region, including Silverton, Ouray and Telluride, are also easily reached by train from Denver. Besides these there are also available the bituminous mines of the Northern Coal Fields, the anthracite fields of Glenwood Springs, the oil fields of Florence, the iron mines of Wyoming, and the copper regions of Arizona and Montana.

No other mining school in the country has within easy access such a wide variety of mining properties, or such excellent opportunities for observing the latest and best smelting operations.

REQUIREMENTS FOR ADMISSION.

FRESHMAN CLASS.

The following requirements for admission to the Freshman Class of the Colorado School of Mines are in harmony with the Report of the Commission of the North Central Association of Colleges and Secondary Schools, adopted March 28, 1902, and are in harmony with the recommendation of the University and High School Conference held at Boulder, Colorado, December 12, 1903. They are also in harmony with the Report of the Committee of the American Mathematical Society on Definitions of College Entrance Requirements in Mathematics, appointed at the summer meeting of the American Mathematical Society, September, 1902.

REQUIREMENTS FOR THE FRESHMAN CLASS.

Unit Course. A unit course of study is defined as a course covering a school year of not less than thirty-five weeks, with four or five (preferably five) periods of at least forty-five minutes each per week.

Sixteen Units are demanded for entrance, of which twelve are required, and four may be chosen from a list of electives.

REQUIRED UNITS.

Algebra	1½	units
Plane Geometry	1	unit
Solid Geometry	½	unit
Languages, other than English	2	units
English	3	units
History	2	units
Physics	1	unit
Chemistry	1	unit
Required Units	12	
Elective Units	4	
Total Units for Entrance	16	

ELECTIVE UNITS.

The four elective units may be selected from the following list: Drawing, 1; Shop Work, 1; Mathematics, ½ or 1; Greek, 1, 2 or 3; French, 1, 2 or 3; German, 1, 2 or 3; Spanish, 1 or 2; History, 1 or 2; English, 1; Science, 1 or 2; Psychology, ½ or 1; Political Economy, ½ or 1.

In allowing credit for drawing and shop work two forty-five-minute periods will be regarded as equivalent to one forty-five-minute period of classroom work. Half units are accepted in all studies, except in physics and chemistry, provided that not less than one full unit shall be accepted in language.

METHODS OF ENTRANCE.

(a) By Certificate.

Graduates of Accredited High Schools in the State of Colorado will be admitted without examination upon the presentation of proper credentials from the Principal of their High School, provided that the studies they have successfully completed cover the requirements for admission. Blanks for this purpose will be sent on application to the President.

Graduates of Accredited High Schools in other States will be accepted in the same manner as graduates of Accredited High Schools in Colorado.

(b) By Examination.

All other candidates for admission will be required to pass entrance examinations in the specified subjects. These examinations are held in Golden.

For the benefit of students who cannot, on account of the distance, conveniently take the examination at Golden, arrangements will be made so that they may take the examinations under the direction of some responsible person at or near their own homes.

Entrance examinations for the class of 1909 will be held in Golden on Wednesday, Thursday and Friday, August 30 and 31, and September 1, 1905.

It is the opinion of the Faculty of the Colorado School of Mines that every candidate for the Freshman class should have taken a thorough course of at least four years in a good High School or in a Manual Training School, or should have received an education equivalent to one of these. The work of the school is so exacting that students who are not well prepared cannot expect to succeed after entrance; consequently, students who are deficient in any study are not admitted.

DESCRIPTION OF THE UNITS REQUIRED FOR ENTRANCE.

ENGLISH (3 UNITS).

(a) GRAMMAR. The student should have a sufficient knowledge of English grammar to enable him to point out the syntactical structure of any sentence which he encounters in the prescribed reading. He should also be able to state intelligently the leading grammatical principles when he is called upon to do so.

(b) READING. The books prescribed by the Joint Committee on Uniform Entrance Requirements in English form the basis for this part of the work.

The list is divided into two parts, the first consisting of books to be read with attention to their contents rather than to their form, the second consisting of books to be studied thoroughly and minutely. The lists, thus divided, are as follows:

I. Books prescribed for reading.

For 1905: Shakespeare's *The Merchant of Venice* and *Julius Caesar; The Sir Rodger De Coverley Papers* in the Spectator; Goldsmith's *The Vicar of Wakefield;* Coleridge's *The Ancient Mariner;* Scott's *Ivanhoe;* Carlyle's *Essay on Burns;* Tennyson's *The Princess;* Lowell's *The Vision of Sir Launfal;* George Eliot's *Silas Marner.*

For 1906, 1907 and 1908: Shakespeare's *The Merchant of Venice* and *Macbeth; The Sir Rodger De Coverley Papers* in The Spectator; Irving's *Life of Goldsmith;* Coleridge's *The Ancient Mariner;* Scott's *Ivanhoe* and *The Lady of the Lake;* Tennyson's *Gareth and Lynette, Lancelot and Elaine,* and *The Passing of Arthur;* Lowell's *The Vision of Sir Launfal;* George Eliot's *Silas Marner.*

II. Books prescribed for study and practice.

For 1905: Shakespeare's *Macbeth;* Milton's *Lycidas, Comus, L'Allegro,* and *Il Penseroso;* Burke's *Speech on Conciliation with America;* Macaulay's *Essays on Milton and Addison.*

For 1906, 1907 and 1908: Shakespeare's *Julius Caesar;* Milton's *Lycidas, Comus, L'Allegro and Il Penseroso;* Burke's Speech on *Conciliation with America;* Macaulay's *Essays on Addison and Life of Johnson.*

(c) Composition. Regular and persistent training in both written and oral composition should be given throughout the entire school course. The topics should be so chosen as to give practice in the four leading types of prose discourse, namely, description, narration, exposition and argument.

(d) Rhetoric. It is expected that the student will be familiar with the essential principles of rhetoric. The instruction in this subject should include the following particulars: choice of words, structure of sentences and paragraphs, the principles of narration, description, exposition and argument. The teacher should distinguish between those parts of rhetorical theory which are retained in text books merely through the influence of tradition and those which have direct bearing upon the composition work. The former may be safely omitted.

HISTORY (2 Units).

Any two of the following may be offered:

I. Ancient History, with special reference to Greek and Roman History, including also a short introductory study of the more ancient nations and the chief events of the early middle ages, down to the death of Charlemagne (814).

II. Mediaeval and Modern European History, from the death of Charlemagne to the present time.

III. English History.

IV. American History, or American History and Civil Government.

PHYSICS (1 Unit).

Physics. The equivalent of Carhart and Chute's *High School Physics,* or Gage's *Principles of Physics,* including systematic laboratory practice such, for example, as is outlined in Crew and Tatnall's *Laboratory Manual in Physics.*

CHEMISTRY (1 Unit).

General Chemistry. The equivalent of Bradbury's *Elementary Chemistry* or Remsen's *Briefer Course in Inorganic Chemistry.*

MATHEMATICS (3 UNITS).

I. ALGEBRA. ($1\frac{1}{2}$ Units.) The four fundamental operations for rational algebraic expressions; factoring, highest common factor; lowest common multiple; complex fractions; the solution of equations of the first degree containing one or more unknown quantities; radicals, including the extraction of the square root of polynomials and numbers; fractional and negative exponents; quadratic equations and equations containing one or more unknown quantities that can be solved by the methods of quadratic equations; problems depending upon such equations; a review of the essentials should be followed by ratio and proportion, and the binominal theorem for positive integral exponents; the progressions; the elementary treatment of permutations and combinations; the use of four and five place tables of logarithms.

II. PLANE GEOMETRY. (1 Unit.) Completed, including the solution of original exercises and numerical problems.

III. SOLID GEOMETRY. ($\frac{1}{2}$ Unit.) Properties of straight lines and planes; of dihedral and polyhedral angles; of projections; of polyhedrons, including prisms; of pyramids and the regular solids; of cylinders, cones and spheres; of spherical triangles, and the measurement of surfaces and solids.

The two units required in languages other than English may be offered in Greek, Latin, French, German or Spanish.

ADMISSION TO ADVANCED STANDING.

GRADUATE STUDENTS. Applicants who are graduates of colleges or technical schools of good standing will be admitted upon the presentation of proper credentials and will be permitted to take any subject taught in connection with the regular courses. Each case will be judged on its own merits, but such applicants will be advised to become candidates for a degree and to complete the regular work of the college.

UNDERGRADUATE STUDENTS. Applicants who have partially completed the course in colleges or technical schools of good standing will be admitted on probation upon the presentation of proper credentials. Due credit will be allowed for the successful completion of work which is equivalent to that given in the Colorado School of Mines. The Faculty reserves the right, however, to examine all such applicants irrespective of the credits brought from another institution. Plates of drawings, laboratory note books, and catalogues of the institution attended, should be submitted with applications for advanced standing. The college does not admit special students. All applicants for advanced standing are expected to enroll in one of the regular classes and to become candidates for a degree. Application blanks for advanced standing will be furnished on request to the President.

DEGREES.

The college offers two four-year courses—Mining Engineering and Metallurgical Engineering—leading up to the degrees of E. M. (Mining Engineer) and E. Met. (Metallurgical Engineer).

THESIS AND GRADUATION.

A thesis upon some suitable subject is a prerequisite to the completion of either course. Each senior shall submit to the Faculty, not later than November 1st, the subject of his thesis, which must be approved by the Professor concerned. Each thesis must be typewritten or printed on eight and one-half by eleven-inch paper, bound in book form and submitted not later than May 1st.

No diploma will be delivered until the thesis is handed in, the full requirements of the course of study are satisfied, and all accounts with the college are settled.

DEPARTMENTS OF INSTRUCTION.

TABULAR VIEW.

MINING ENGINEERING.

Freshman Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
College Algebra [p. 66]	5		Coördinate Geometry [p. 67]	5	
Trigonometry and Determinants [p. 67]	3		Elements of Analysis [p. 67]	3	
General Chemistry [p. 61]	5		General Chemistry [p. 61]	5	
Qualitative Analysis [p. 62]		9	Qualitative Analysis [p. 62]		6
Mechanical Drawing [p. 55]		6	Mechanical Drawing [p. 56]		9
Descriptive Geometry [p. 55]	2		Descriptive Geometry [p. 56]	2	
General Geology [p. 42]	3		Plane Surveying [p. 47]	2	
Geology: Field-Work [p. 43] Four Trips on Saturdays.			Geology: Field-Work [p. 43]. Four Trips on Saturdays		

Plane Surveying: Field-Work [p. 47]. Four weeks in the summer following the regular college year.

General Mining Trips, as follows: [p. 33]

1. Oldtown and Cook Mines, Central City.
2. Gem Mine and Newhouse Tunnel, Idaho Springs.
3. Colorado-Central or others at Georgetown.
4. Leyden Coal Mine.

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENGINEERING—Continued.

Sophomore Year.

FIRST SEMESTER	Rect. Hrs.	Lab. Hrs.	SECOND SEMESTER	Rect. Hrs.	Lab. Hrs.
Differential and Integral Calculus [p. 68]	5		Integral Calculus [p. 68]	3	
General Physics: Mechanics, Heat, and Sound [p. 64]	4		Differential Equations [p. 69]	2	
Physical Laboratory [p. 65].		3	General Physics: Electricity, Magnetism, and Optics [p. 65]	4	
Quantitative Analysis: Gravimetric [p. 62]	1	9	Physical Laboratory [p. 65]		3
Technical Chemistry [p 63]	2		Quantitative Analysis: Volumetric [p. 62]	1	9
Crystallography and Blowpipe Analysis [p. 44]	2	6	Determinative Mineralogy [p. 45]	2	6
Mine Surveying [p. 29]	2		Mine Surveying [p. 29]	2	
			Technical Chemistry [p. 63]	2	

Mine Surveying: Field-Work [p. 30]. Four weeks in the summer following the regular college year.

Mining Trips, for the study of mining methods, as follows: [p. 34]
1. Cripple Creek and vicinity.
2. Northern Coal Fields.

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENGINEERING—Continued.

Junior Year.

FIRST SEMESTER	Rect. Hrs.	Lab. Hrs.	SECOND SEMESTER	Rect. Hrs.	Lab. Hrs.
Advanced Geology [p. 43]	4		Lithology [p. 45]	2	2
Metallurgy: Fuels, Refractory Materials, Iron and Steel [p. 35]	4		Metallurgy: Lead [p. 36]	4	
Mining [p. 30]	3		Mining [p. 30]	3	
Mechanics [p. 48]	5		Mechanics [p. 50]	3	
Testing Laboratory [p. 48]		3	Construction [p. 50]	2	3
Machine Design [p. 56]	2		Machine Design [p. 57]	2	
Machine Design Drawing [p. 58]		6	Machine Design Drawing [p. 58]		6
Assaying and Metallurgical Laboratory [p. 36]	1	9	Geology, Advanced Field-Work: Four full days [p. 43]		
Metallurgical Trips, as follows: [p. 40]			Metallurgical Trips, as follows: [p. 40]		
1. Coking Plant			1. Smelting Plant for the study of furnace types		
2. By-product Plant and Gas Producers			2. Iron and Steel Works		
3. Refractory Materials			3. Lead Smelter		

Mining Trips, [p. 34]. Four during the year, to illustrate shaft sinking, tunneling, and construction work. Mining and Metallurgical Trips to the Black Hills and Montana, four weeks in the summer after the regular college year. [p. 41]

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENGINEERING—Concluded.

Senior Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Economic Geology [p. 44]	3		Economic Geology [p. 44]	3	
Ore Dressing and Metallurgy of Copper [p. 37]	3		Metallurgy: Gold, Silver and Zinc [p. 39]	3	
Ore Dressing Laboratory [p. 38]		3	Metallurgical Practice [p. 40]		3
Structures [p. 51]	2	6	Contracts and Specifications [p. 53]	2	
Hydraulics and Hydraulic Motors [p. 52]	2		Steam Laboratory [p. 60]		3
Hydraulic and Cement Laboratories [pp. 51, 52]		3	Electric Power Transmission [p. 59]	2	
Mining Machinery [p. 31]	3		Electrical Laboratory [p. 60]		3
Mining [p. 31]	3		Mining Machinery [p. 32]	3	
Mine Examination and Reports [p. 31]	1	3	Mining [p. 32]	2	3
Thesis			Mine Examination and Reports [p. 33]	2	3
Ore Dressing Trips, as follows: [p. 41]			Thesis		
1. Sampling Works			Metallurgical Trips, as follows: [p. 41]		
2. Concentrating Plants			1. Copper Smelter		
3. Magnetic and Electric Separating Plants			2. Gold Milling Plant		
			3. Cyanide and Chlorination Mills		
			4. Zinc Smelter		

Mining Trips during the year: One to Leadville, Aspen, and Breckenridge for special study in timbering, pumping, and hydraulic mining; other special trips for inspection and testing of power plants and mine machinery, and examination and sampling of mining properties. [p. 34]

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING.

Freshman Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
College Algebra [p. 66].	5		Coördinate Geometry [p. 67]	5	
Trigonometry and Determinants [p. 67]...........	3		Elements of Analysis [p. 67]	3	
General Chemistry [p. 61]..	5		General Chemistry [p. 61].	5	
Qualitative Analysis [p. 62].		9	Qualitative Analysis [p. 62]		6
Mechanical Drawing [p. 55].		6	Mechanical Drawing [p. 56]		9
Descriptive Geometry [p. 55]...................	2		Descriptive Geometry [p. 56]	2	
General Geology [p. 42]	3		Plane Surveying [p. 47]...	2	
			Geology: Field-Work [p. 43]. Four Trips on Saturdays		

Plane Surveying: Field-Work [p. 47]. Four weeks in the summer following the regular college year.

General Mining Trips, as follows: [p. 33]
1. Oldtown and Cook Mines, Central City.
2. Gem Mine and Newhouse Tunnel, Idaho Springs.
3. Colorado-Central or others, at Georgetown.
4. Leyden Coal Mine.

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Continued.

Sophomore Year.

FIRST SEMESTER	Rect. Hrs.	Lab. Hrs.	SECOND SEMESTER	Rect. Hrs.	Lab. Hrs.
Differential and Integral Calculus [p. 68]	5		Integral Calculus [p. 68]	3	
General Physics: Mechanics, Heat and Sound [p. 64]	4		Differential Equations [p. 69]	2	
Physical Laboratory [p. 65].		3	General Physics: Electricity, Magnetism and Optics [p. 65]	4	
Quantitative Analysis: Gravimetric [p. 62]	1	9	Physical Laboratory [p. 65]		3
Technical Chemistry [p. 63]	2		Quantitative Analysis: Volumetric [p. 62]	1	9
Crystallography and Blowpipe Analysis [p. 44]	2	6	Technical Chemistry [p. 63]	2	
Mine Surveying [p. 29]	2		Determinative Mineralogy [p. 45]	2	6
			Mine Surveying [p. 29]	2	

Mine Surveying: Field-Work [p. 30]. Four weeks in the summer following the regular college year.

Mining Trips, for the study of mining methods, as follows: [p. 34]

1. Cripple Creek and vicinity.
2. Northern Coal Fields.

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Continued.

Junior Year.

FIRST SEMESTER	Rect. Hrs.	Lab. Hrs.	SECOND SEMESTER	Rect. Hrs.	Lab. Hrs.
Advanced Geology [p. 43]	4		Lithology [p. 45]	4	
Metallurgy: Fuels, Refractory Materials, Iron and Steel [p. 35]	4		Metallurgy: Lead [p. 36]	4	
Mining [p. 30]	3		Mining [p. 30]	3	
Mechanics [p. 48]	5		Mechanics [p. 50]	3	
Testing Laboratory [p. 48]		3	Construction [p. 50]	2	3
Machine Design [p. 58]	2		Assaying and Metallurgical Laboratory [p. 36]	1	9
Machine Design Drawing [p. 59]		3	Machine Design Drawing [p. 59]		3
Metallurgical Chemistry [p. 63]		9	Geology, Advanced Field Work: Four full days [p. 43]		
Metallurgical Trips, as follows: [p. 40]			Metallurgical Trips, as follows: [p. 40]		
1. Coking Plant			1. Smelter Plant for the study of furnace types		
2. By-product Plant and Gas Producers			2. Iron and Steel Works		
3. Refractory Materials			3. Lead Smelter		

Mining Trips [p. 34]. Four during the year to illustrate shaft sinking, tunneling, and construction work. Metallurgical and Mining Trips to the Black Hills and Montana, four weeks in the summer after the college year. [p. 41]

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Concluded.

Senior Year.

FIRST SEMESTER	Rect. Hrs.	Lab. Hrs.	SECOND SEMESTER	Rect. Hrs.	Lab. Hrs.
Economic Geology [p. 44]	3		Economic Geology [p. 44]	3	
Ore Dressing and Metallurgy of Copper [p. 37]	3		Metallurgy: Gold, Silver and Zinc [p. 39]	3	
Electro-Metallurgy [p. 38]		3	Metallurgy: Aluminum, Nickel [p. 39]	3	
Ore Dressing Laboratory [p. 38]		3	Metallurgical Laboratory [p. 40]		3
Structures [p. 51]	2	6	Metallurgical Practice [p. 40]		6
Hydraulics and Hydraulic Motors [p. 52]	2		Contracts and Specifications [p. 53]	2	
Hydraulic and Cement Laboratories [pp. 51, 52]		3	Mining [p. 31]	2	
Mining [p. 31]	3		Mine Examination and Reports [p. 33]	2	3
Mine Examination and Reports [p. 31]	1	3	Electric Power Transmission [p. 59]	2	
Thesis			Electrical Laboratory [p. 60]		3
Ore Dressing Trips, as follows: [p. 41]			Thesis		
1. Sampling Works			Metallurgical Trips, as follows: [p. 41]		
2. Concentrating Plants			1. Copper Smelter		
3. Magnetic and Electric Separating Plants			2. Gold Milling Plant		
			3. Cyanide and Chlorination Mills		
			4. Zinc Smelter		

Mining Trips during the year: One to Leadville, Aspen and Breckenridge, for special study in timbering, pumping, and hydraulic mining; other special trips for inspection and testing of power plants and mine machinery, and examination and sampling of mining properties. [p. 34]

The courses are described on the pages indicated after each course.

MINING.

Professor Lewis Emanuel Young.

The courses in this department are designed to instruct the student in the theory and practice of mineral claim and underground surveying; in the application of the sciences to the art of mining; in the principles and applications of the power machinery used in the mineral industry; in the best methods and practices of mining engineers and mine managers.

I. MINE SURVEYING.

This course includes instruction in the practices of underground surveying and the platting of the various maps and sections necessary to show the workings of a mine. The various methods of coal, copper, iron, and precious metal districts are discussed in detail. Special attention is given to the use of the auxiliary telescope and the calculations which its use necessitates. Other subjects emphasized are: surveying with the hand transit; the estimation of the tonnage in ore bodies; surveys for underground connections; the organization of the drafting room and office.

Prerequisite: The completed work of the Freshman year.

Text: Johnson, *Theory and Practice of Surveying.*

Two hours per week during the first semester of the Sophomore year.

(Young.)

II. MINE SURVEYING.

The methods used in locating and patenting mining claims, together with the most important divisions of the law relating to surveys, are taught in this course. Methods used in the United States receive especial attention, while the practice in Mexico, British Columbia, South Africa, and Australia is described in some detail.

Prerequisite: Course I.

Texts: Johnson, *Theory and Practice of Surveying*.
Morrison, *Mining Rights.*

Two hours per week during the second semester of the Sophomore year.

(Young.)

III. MINE SURVEYING. FIELD-WORK.

Each student is given personal instruction and practice in the survey of mines and mining claims. The squads are limited in size in order that each man may learn all the details of the work and appreciate the importance of every phase of the subject. Among the problems assigned are the following: the complete survey of a mining claim; the survey and mapping of a coal or clay mine; the survey and mapping of a metal mine; the complete survey and mapping of a property, including claims, buildings, and mine workings.

Prerequisites: Courses I. and II.

Four weeks in the summer following the regular work of the Sophomore year.

(Young.)

IV. MINING.

This course is preliminary to the lectures on mining methods, and includes excavating and breaking ground, prospecting, boring, tunneling, and shaft sinking. The various tools used in excavating, boring, and drilling, the use of explosives in breaking ground, the methods and tools of prospecting and the general and special methods of tunneling and shaft sinking are described in detail in the classroom.

Prerequisites: The completed work of the Sophomore year.

Texts: Gillette, *Earthwork and Its Cost.*
Ihlseng and Wilson, *A Manual of Mining.*

Three hours per week during the first semester of the Junior year.

(Young.)

V. MINING.

A study of methods used in securing the various mineral products comprises the work of this course. The economical systems developed in coal, copper, iron and low-grade gold and silver mines are studied in detail. The application of these systems to the various types of deposits is emphasized throughout the lectures.

Prerequisite: Course IV.

Text. Ihlseng and Wilson, *A Manual of Mining.*

Three hours per week during the second semester of the Junior year.

(Young.)

VI. MINING.

In this course the following topics receive attention: systems of transporting the mineral product underground, of bringing it to the surface, of carrying it to the mills and railroads, and of draining and unwatering mines. The detailed study of the machinery necessary in these operations is included in Courses VII. and X.

Prerequisite: The completed work of the Junior year.

Text: Ihlseng and Wilson, *A Manual of Mining.*

Three hours per week during the first semester of the Senior year.

(Young.)

VII. MINING MACHINERY.

This course includes a study of the steam engine and boiler, the steam turbine, the injector, and the steam engine indicator. Such types of engines as are used in mining operations are studied in detail. The lectures emphasize the economies possible in the application of power in mining.

Prerequisite: The completed work of the Junior year.

Texts: Hutton, *The Mechanical Engineering of Power Plants.*
Kent, *Mechanical Engineers' Pocketbook.*

Three hours per week during the first semester of the Senior year.

(Young.)

VIII. MINE EXAMINATION AND REPORTS.

This course is given in order to prepare students for general field-work, the preparation of reports, and the examination of mining properties. The lectures comprise the presentation and discussion of the different types of reports which a mining engineer may be called upon to make, the facts which should be included in such reports, and the form and style in which they should be written and illustrated. Each student studies and criticizes various reports preparatory to submitting any original work. Reports on prospects and machinery are then submitted by each student.

Prerequisite: The completed work of the Junior Year.

One lecture and one afternoon per week during the first semester of the Senior year.

(Young.)

IX. MINING.

This course is a continuation of Course VI., and includes lectures on mine ventilation, safety appliances in mines, mine laws and regulations, and mine management and accounts. Each of these topics is given such attention as its importance warrants. The gases present in coal and metalliferous mines, the economy of ventilating machinery at metal mines, accidents and their prevention, first aid to the injured, the regulations governing workmen and the use of machinery, are studied carefully. The general organization, design, and management of mining plants is presented in the drafting room, supplementing the lectures on the machinery in detail. Typical plants of precious metal, copper, iron, and coal mines are examined and studied in order to emphasize the varying requirements.

Prerequisites: Courses VI. and VII.

Text: Ihlseng and Wilson, *A Manual of Mining.*

Two hours per week and one afternoon during the second semester of the Senior year.

(Young.)

X. MINING MACHINERY.

The work of this course includes the application of machinery to mining operations, the possible economies and a detailed study of the most important machines used in mining. The following machines are studied: power drills, coal cutting machines, steam shovels, dredges, motors, hoists, pumps, mechanical ventilators, conveyors, and tramways.

Numerous catalogues are introduced to show the best types of machines.

Prerequisites: Courses VI. and VII.

Three hours per week during the second semester of the Senior year.

(Young.)

XI. MINE EXAMINATION AND REPORTS.

The lectures of this course discuss in detail the field methods of the best engineers in preparing the various reports outlined in Course VIII. The methods of sampling and estimating ore bodies are studied carefully, and each student is required to sample several properties and to make complete reports.

Prerequisite: The completed work of the first semester of the Senior year.

Two lectures and one afternoon per week during the second semester of the Senior year.

(Young.)

MINING TRIPS.

Throughout the four years the classes make many trips to mines in order to see the varying practice and the operations and machinery described in the class room. The trips are planned to illustrate definite operations, to develop the power of observation and the ability to report concisely such observations. Each new student is encouraged to make a study of some district and, whenever possible during his college course, to apply principles, methods, and criticisms to that district.

Freshman Year. During this year the following mines are visited: the Cook, or Oldtown Mines, at Central City; the Gem Mine and Newhouse Tunnel at Idaho Springs, and the Colorado Central Mine at Georgetown. These trips bring before the student methods of shaft sinking, tunneling, drifting and stoping, and illustrate practice in haulage, hoisting, and pumping. A general report, including sketches of various assigned subjects, is required of each student.

Sophomore Year. The Cripple Creek District is visited in order to illustrate underground operations in general, and special methods of mining, timbering, and drainage. Numerous maps and models of mines emphasize topics discussed in the lectures on mine surveying. The class also visits in the Northern Coal Fields mines which illustrate methods of mining, ventilation, haulage, and timbering.

Junior Year. During the Junior year several trips are made in order to illustrate local practice in shaft sinking and tunneling and other important operations. After the regular college year an extended trip is made to South Dakota and Montana. Methods of mining and handling low-grade ore are well illustrated on this trip. The equipment of mine plants is studied carefully, and available data are collected by each student in order to furnish practical examples in the study of mine plants during the Senior year. Carefully prepared reports are required at the end of the trip.

Senior Year. The trips of the Senior year include, whenever possible, illustrations of mining operations, construction work, and power machinery. Leadville, Aspen, and Breckenridge are visited and furnish illustrations of timbering, pumping, and placer mining. The course in mine examination and reports requires each student to make several additional trips for the examination of properties.

METALLURGY.

Professor Frank Weiss Traphagen.
Instructor William George Haldane.
Instructor John Christian Bailar.

The aim of this department is to provide a foundation for practical work in metallurgy. In the lecture room attention is constantly directed to the principles involved in the treatment of ores, especially to chemical reaction and the influence of mass, temperature and other conditions upon these changes. In the laboratory, metallurgical operations are given a critical study, and all the resources of the chemical and of the assay laboratories are drawn upon. The purpose is to equip the college with working size apparatus, illustrating the different types of metallurgical and ore dressing plants, and to have these operated by students, who will check up each operation by careful tests in the laboratories.

1. METALLURGY. *Fuels, Refractory Materials, Furnaces, Iron and Steel.*

FUELS. This course begins with the study of combustion, which includes the questions of flames, of complete combustion, luminosity and of amounts of air required, many of the points being considered mathematically. The various fuels of metallurgical importance are given very careful consideration. Artificial fuels, coke, charcoal, producer gas and briquetting are dwelt upon at considerable length. The question of by-products receives the special attention demanded by its importance and its future certain wide use in this country. Furnaces of various types are, at this point, given a preliminary study as a foundation for the more detailed study to be given under the particular metals.

REFRACTORY MATERIALS. Their source, preparation, properties and application.

IRON AND STEEL. The development of the metallurgy of iron, together with the general application of labor-saving devices, makes this the metal the study of which should be taken up first, especially because of its wide use for structural purposes and for the machinery so generally used in ore dressing and metallurgical plants. The order of treatment is indicated by the following subdivisions of the subject: the ores of iron; metallurgical chemistry of iron; the production of pig iron; the blast furnace, hot blast stoves; fuel, blast charges, yield and waste gases of the blast furnace; castings of iron; wrought iron; the production of wrought iron direct from the ore; the production of wrought iron in open hearth furnaces; refining of pig iron; puddling; forge and mill machinery;

steel and ingot iron, and the production of steel by various methods.

Prerequisite: The completed work of the Freshman and Sophomore years.

Texts: Sexton, *Fuel and Refractory Materials.*
Greenwood, *Steel and Iron.*

Four hours per week during the first semester of the Junior year.

(Traphagen, Haldane.)

II. METALLURGY.

Lead. This course is considered under the following subdivisions: properties of lead and its compounds; ores of lead; receiving, sampling, and purchasing ores, fluxes and fuels; smelting in the reverbatory furnace; smelting in the ore hearth; smelting in the blast furnace; furnace products; desilverization; Pattinson process; Parkes process; German and English cupellation. At the proper place in this course considerable attention is given to the calculation of furnace charges.

Prerequisite: Course I.

Text: Hofman, *The Metallurgy of Lead.*

Four hours per week during the second semester of the Junior year.

(Traphagen, Haldane.)

III. ASSAYING AND METALLURGICAL LABORATORY.

Special attention is directed toward making this course as practical as possible, and, while the importance of accurate work is at no time lost sight of, constant efforts are made to enable the student to handle a large amount of work in as short a time as possible. As nearly as may be the student is put under smelter conditions, and is early made familiar with the system prevailing in the best conducted laboratories, so that in the end he may be able to take his place at once in such a laboratory without undergoing a "breaking-in" course after leaving school.

The work includes all the assays called for in the laboratory of mine, mill or smelter, and the methods, besides those in use so satisfactorily for many years, include also such "short cuts" as have been introduced by assayers having several hundred assays to make daily. The course covers the following: the fusibility of slags of definite composition made up by careful calculation; the fluxing of a limestone ore and a silicious ore for practice; the running of lead mixtures of known lead, silica and base content, to determine the influence of foreign elements; the assay of sulphide and oxide ores of lead; the assay of gold and silver ores of different types by various methods, with a comparison of results; the assay of zinciferous and cupriferous gold and silver ores, of arsenical and antimonial ores; the crucible and scorification assay of mattes and concentrates; the assay of gold, silver and base bullions, of tin and antimony ores and special assays.

In connection with the assaying a preliminary course in the metallurgical laboratory is given. The following points are studied: the fusibility of silicates; corrosion of refractory materials; pyrometry; calorimetry; heat treatment of steel; roasting of copper sulphide ores; Parkes desilverizing.

Prerequisites: Course I. and the completed work of the Freshman and Sophomore years.

Laboratory Manual: Howe, *Metallurgical and Laboratory Notes.*

One lecture and nine hours laboratory work per week during one semester of the Junior year.

(Traphagen, Haldane.)

IV. ORE DRESSING AND METALLURGY OF COPPER.

ORE DRESSING. The following represent the main divisions under which this subject is studied: jaw and gyratory breakers; rolls; stamps, gravity, steam and pneumatic; special crushing and fine grinding apparatus; apparatus for sizing, including the various types of screens and classifiers; the actual concentrating machines, including jigs, tables and vanners.

COPPER. This subject is considered under the following sub-heads: copper and its ores; distribution of the ores of copper; the sampling and assaying of copper; the chemistry of the calcining process; the preparation of ores for roasting; the roasting of ores in lump form; the roasting of ores in pulverized condition; automatic reverberatory calciners; the smelting of copper; the chemistry of the blast furnace; blast furnaces constructed of brick; blast furnace smelting; pyritic smelting; reverberatory furnaces; the bessemerizing of copper mattes; the electrolytic refining of copper, and the selection of process and arrangement of plant.

Prerequisites: Courses I. II. and III.

Reference: Richards, *Ore Dressing.*

Text: Peters, *Modern Copper Smelting.*

Three hours per week during the first semester of the Junior year.

(Traphagen, Bailar.)

V. ORE DRESSING LABORATORY.

This laboratory is equipped with laboratory classifiers of different types, small and large jigs, laboratory slime tables, sizing screens, various types of crushers, and a Wilfley table. The work consists of sizing tests of the products of various crushers and operations, concentrating by panning and by various mechanical devices, and comparative studies of the different forms of commercial concentrating devices.

Prerequisites: Courses I. II. and III.

Three hours per week during the first semester of the Senior year.

(Traphagen, Haldane.)

VI. ELECTRO-METALLURGY.

The growing application of the electric current to metallurgy for electrolysis, especially in refining, and for electric smelting, renders a knowledge of these subjects by the present day metallurgist imperative. The general principles of electrolysis is taken up. This includes a careful study of the quantitative relationship between the current and the amount of metal deposited, illustrated by numerous problems, together with studies of the installation of the various electrolytic plants under different systems. Laboratory work accompanies this course.

Prerequisites: Courses I. II. and III.

Three hours per week during the first semester of the Senior year.

(Traphagen.)

VII. METALLURGY. *Gold, Silver and Zinc.*

Gold and Silver. This course covers the following: metallurgy of gold and silver, including stamp milling, cyanidation, and chlorination of gold ores; chloridizing, roasting, and amalgamation of silver ores; the Russell process and other wet methods for silver; the parting of gold and silver bullion by various commercial methods, with special attention to electrolysis and the sulphuric acid treatment. The various modifications of the cyanide process receive particular attention, especially the treatment of the slimes from zinc precipitation; the Moore filter process; the regeneration of the cyanide; the different methods proposed for precipitating the dissolved gold and the recent attempts to apply the process to silver ores.

Zinc. The present great interest in this metal, together with a growing demand, is the reason why a course of lectures is to be devoted to this metal. These lectures deal with the dressing of the various ores of zinc, which involve wet concentration by the usual form of tables or vanners, and dry treatment by magnetic or electro-static separators. The various methods for the smelting of zinc ores will be considered in detail, especially those for the production of the zinc-lead paint, those using wet methods and those using regenerative furnaces in connection with the old Belgian method.

Prerequisites: Courses I. II. III. IV. V. and VI.

Reference: Ingalls, *The Metallurgy of Zinc.*
Park, *The Cyanide Process.*

Three hours per week during the second semester of the Senior year.

(Traphagen.)

VIII. METALLURGY. *Aluminum, Nickel and Metals not elsewhere considered.*

This course covers the general metallurgy of the metals not previously considered. A study of alloys is made here, and various alloys, especially those of the rarer metals with iron, are given particular attention.

Prerequisites: Courses I. II. III. IV. V. and VI.

Three hours per week during the second semester of the Senior year.

(Traphagen.)

IX. METALLURGICAL LABORATORY.

This course includes optical pyrometers; Juncker calorimeter; testing refractory materials for fusibility; influence on refractory power of various elements; thermal gradient; various experiments with iron and steel; microstructure of steel; copper selecting process and chloridizing roasting.

Prerequisites: Courses I. II. III. IV. V. and VI.

Laboratory Manual: Howe, *Metallurgical Laboratory Notes.*

Three hours per week during the second semester of the Senior year.

(Traphagen, Haldane.)

X. METALLURGICAL PRACTICE.

This course covers the operation of working machines of the various types used in practical metallurgy, including stamp milling, roasting and smelting ores, cyanide and chlorination practice. The aim in equipping the school is to follow the best modern practice in the installation of metallurgical devices, and to endeavor, whenever possible, to secure full size commercial units in place of small model plants.

Prerequisites: Courses I. II. III. IV. V. and VI.

Six hours per week during the second semester of the Senior year.

(Traphagen.)

METALLURGICAL TRIPS.

Immediately after taking up the study of metallurgy, trips extending throughout the Junior and Senior years are begun. These trips, intended to illustrate the lectures. are taken while the particular topics are under discussion, and tend to aid greatly in an appreciation of approved machinery and practice. By means of outlines furnished the student, which he is required to fill out, care is taken that all the important points in connection with each plant visited are studied and reported upon.

Junior Year. The gas producing and coking plant of the Denver Gas and Electric Company at Denver is first visited, and a general study of artificial fuels is made. The manufacture of refractory materials is then taken up, followed by a visit to the Globe plant of the American Smelting & Refining Company at Denver, and the Pyritic Smelter at Golden, for the study of furnaces of various types. Near the conclusion of the lectures on iron and steel, several days are spent in the immense modern plant of the Colorado Fuel and Iron Company at Pueblo. The various practices in the treatment of lead ores are studied at the smelters of the American Smelting and Refining Company at Denver and Pueblo, including the Globe, Eilers, Philadelphia, and Pueblo plants. During the summer succeeding the Junior year the gold milling and cyaniding plants of the Black Hills and the copper smelters and refineries at Butte and Anaconda are visited.

SENIOR YEAR. The early part of the year is devoted to studies and reports upon the sampling mills and ore dressing plants of Gilpin and Clear Creek counties. This is followed by a study of pyritic and copper smelting at the Pyritic Smelter near Golden and at the Philadelphia plant of the American Smelting and Refining Company at Pueblo. The applications of magnetic separators are illustrated by visits to the works of the Colorado Zinc Company at Denver, and at other plants where various separators are used. The application of the electro-static current to ore separation is shown in practical operation in the experimental and commercial plants at Denver operating the Blake Morscher machines. The milling of gold ores at Idaho Springs, the operation of chlorination at the Portland and Telluride Mills in Colorado, the Economic Mill at Victor, and cyanidation at the Dorcas Mill, Florence, furnish excellent studies in the metallurgy of this important metal. A study of the metallurgy of zinc is made possible by the plants of the Empire Zinc Company and United States Smelting Company at Canon City, and the plant of the American Smelting and Refining Company at Pueblo. In addition to all this Denver is usually selected for the exploitation of new methods in ore dressing and metallurgy, and opportunities to see these demonstrations are open to students.

GEOLOGY AND MINERALOGY.

Professor Horace B. Patton.
Instructor Julius Wooster Eggleston.
Instructor G. Montague Butler.

The Colorado School of Mines is very fortunately situated from the view point of the geologist. The surrounding formations not only present the strikingly clear features so characteristic of the West, but occur in great profusion and variety. In addition certain features peculiar to this particular location afford sufficiently complicated problems to be of great value to the student of geology. It is possible, therefore, without going more than a mile or two from the school to illustrate very effectively most geological problems; and field geology can be carried on at the same time with class instruction.

The subjects presented are classified under three heads: A, Geology; B, Mineralogy; C, Lithology.

A. GEOLOGY.

I. GENERAL GEOLOGY.

This course is intended as a preliminary one and is a preparation for the more advanced course given in the Junior year. It discusses general geological principles more particularly in connection with dynamical, structural, and physiographic geology. The course is essentially a lecture course based on a text book.

Prerequisite: Entrance requirements.

Text: Chamberlin and Salisbury, *Geology (Vol. I, Processes and Their Results.)*

Three hours per week during the first semester of the Freshman year.

(Eggleston.)

II. GEOLOGICAL FIELD-WORK.

In connection with Course I. a certain amount of field work is required. It is intended to illustrate the general principles of geology, including training in the recognition of the simpler types of rocks and in the observation of their attitude and structure; in the use of simple field instruments; in note taking and making of reports; in mapping and section drawing. The work is continued in the second semester, when particular problems are assigned to individual students or squads. These problems are mainly structural in character, such as the tracing and mapping of veins and contacts; the location and study of faults; the mapping and reporting upon clay pits.

Prerequisite: Geology, Course I.

Eight afternoons, or their equivalent; four during each semester of the Freshman year.

(Eggleston, Patton, Butler.)

III. ADVANCED GEOLOGY.

This course is a continuation of Course I., and is given by means of lectures and text-book work. It deals mainly with historical and stratigraphic geology, with special reference to American areas.

Prerequisites: Mineralogy, Courses I. II. and III.
Geology, Course I.

Text: Chamberlin and Salisbury, *Geology (Vol. II).*

Four hours per week during the first semester of the Junior year.

(Eggleston.)

IV. ADVANCED GEOLOGICAL FIELD-WORK.

This course embraces mainly field work in areal geology. Each student is assigned a particular section which he is to study, map, and report upon. This throws the student upon his own resources and gives him not only further practice in geological observation, but also the necessary training for preparing reports based upon his own observations.

Prerequisites: Courses I. II. and III.

Four full days in the field, or their equivalent, during the second semester of the Junior year.

(Eggleston, Patton, Butler.)

V. ECONOMIC GEOLOGY.

This course discusses the matter of ore deposits, their nature, occurrence and origin, especially the ores carrying the precious metals. Attention is also given to other natural products of economic value, such as coal, petroleum, and building stones.

Prerequisites: Geology, Courses I. II. III. and IV.
Mineralogy, Courses I. II. and III. and
Lithology, Course I.

Three hours per week throughout the Senior year.

(Patton.)

B. MINERALOGY.

I. CRYSTALLOGRAPHY.

This course is treated as an essential part of the general work in mineralogy, and only such portion of the subject is especially emphasized as is of practical value in the determination and the proper understanding of minerals. A very thorough drill, however, is given in the more practical portions of the subject. The course is presented through lectures, text books, and practical laboratory work; also by individual quizzes. In connection with the laboratory work each student is required to become thoroughly familiar with crystal forms and combinations such as are found on the usual wooden crystal models, and to determine with the aid of a pocket lens and contact goniometer the crystal forms of three hundred crystals.

Prerequisites: Chemistry, Courses I. and II.

Text: Patton, *Lecture Notes on Crystallography.*

Lectures two hours, laboratory six hours per week, during the first semester of the Sophomore year (ten weeks).

(Patton, Eggleston, Butler.)

II. BLOWPIPE ANALYSIS.

This course is not intended as an independent one, but merely as preliminary to determinative mineralogy. Special attention is devoted to a few of the most useful tests for the common mineral elements, and the student is expected to become expert in the use of the blowpipe within this limited range.

Prerequisites: Mineralogy, Course I.
Chemistry, Courses I. and II.

Text: Moses and Parsons, *Mineralogy, Crystàllography and Blowpipe Analysis.*

Lectures two hours, laboratory six hours per week, from the close of Course I. to the Christmas holidays of the Sophomore year (five weeks).

(Patton, Eggleston, Butler.)

III. DETERMINATIVE MINERALOGY.

In this course about two hundred fifty of the most important mineral species are presented by lectures, in which special emphasis is laid on the most ready means for recognizing minerals by means of their physical properties and crystal forms. The object constantly kept in mind is not the training that will enable one to determine any mineral whatever, but rather to recognize at sight such minerals as are likely to be met with in connection with mining operations. This is what the average mining engineer is expected to do. With this object in view, as thorough a drill as the time will allow is given in the actual handling and determining of minerals in the laboratory. In this work each student is expected to handle, determine, and be examined on, approximately two thousand five hundred individual specimens.

Prerequisites: Chemistry, Courses I. and II.
Mineralogy, Courses I. and II.

Text: Moses and Parsons, *Mineralogy, Crystallography and Blowpipe Analysis.*

Lectures two hours, laboratory six hours per week, from the close of the Christmas holidays to the close of the second semester of the Sophomore year (twenty-two weeks).

(Patton, Eggleston, Butler.)

C. LITHOLOGY.

I. LITHOLOGY.

This is a lecture course supplemented by laboratory work. The object is to present all the more commonly occurring rocks in such a way as to render their identification at sight reasonably accurate. The methods pursued are purely those applicable to the hand specimen without the aid of microscopic sections. The collection of the school is especially rich in those rocks that are usually encountered in mining operations in Colorado and adjacent states. Special emphasis, therefore, is laid upon such rocks and upon their various alteration forms.

Prerequisites: Geology, Courses I. II. and III.
Mineralogy, Courses I. II. and III.

Text: Kemp, *Handbook of Rocks.*

Four hours per week during the second semester of the Junior year.

(Patton, Eggleston, Butler.)

CIVIL ENGINEERING.

Professor Claude William Leroy Filkins.
Assistant Professor William Jonathan Hazard.
Instructor William Franklin Allison.

The aim of this department is to prepare the student to make all the necessary surveys, calculations, and estimates that the mining and metallurgical engineer may be called upon to make, and at the same time to give him such a knowledge of plane surveying as will enable him to undertake any of the work that the surveyor is called upon to do in land, city, topographical, and railroad surveying. The practical is constantly emphasized, and to that end the work assigned to the student is such work as the surveyor meets in practice. The many advantages offered by the mineral, coal and clay mines in actual operation near Golden, together with the interest taken by the operators of these mines, as is shown by their willingness to give classes right of way for practicing surveying, make the college particularly strong in this kind of work. This department also aims to perfect the engineering student in the theoretical discussion of strains and stresses in mechanisms and structures. It teaches the practical application of the theory in the design of machinery in general and of structures in detail. The course in hydraulics and hydraulic motors develops the theoretical, empirical, and practical sides of hydraulics. Thorough laboratory practice is required in connection with the courses, thus providing concrete applications of elementary and involved principles.

I. PLANE SURVEYING.

Instruction is given by lectures and recitations in the theory of the construction, use and care of the surveyor's instruments of precision. The work includes the adjustment of instruments; the theory and use of the barometer, planimeter and plane-table; the principles of land, city, topographical, and railroad surveying, and the determination of the true meridian by means of various solar attachments and by direct observation of the sun and of circumpolar stars.

Prerequisites: Mathematics, Courses I. and II.
Machine Design, Courses I. and II.

Text: Johnson, *Plane Surveying.*

Two hours per week during the second semester of the Freshman year.

(Allison.)

II. SURVEYING. FIELD-WORK.

This course includes adjusting instruments; traverse surveying; observations and calculations for determining distances, areas and volumes; observations for the location of the true meridian; the ordinary problems in city surveying; stadia work in connection with a topographical survey of some section near Golden. A short railway line is located, cross-sectioned, and the earthwork computed.

Prerequisites: Course I.
Mathematics, Courses I. II. III. and IV.
Machine Design, Courses I. II. III. and IV.

Texts: Pence and Ketchum, *Field Manual for Surveyors.*
Searles, *Manual for Railroad Engineers.*

This course occupies the four full weeks following the completion of the Freshman year.

(Allison.)

III. MECHANICS.

The course consists of the theoretical study of mechanisms and materials, embracing statics of a material point and of rigid bodies; centers of gravity or centroids; chains, cords and cables; moments of inertia and radii of gyration of plane figures; stresses and strains; tension, shearing, compression; torsion, flexure; combined torsion and flexure; elastic curves; safe loads; oblique forces; long columns and continuous beams. Much emphasis is placed upon the rapid and accurate application of principles to commercial forms of materials and mechanisms. The course also introduces the student to the fundamental ideas of the motions of bodies, initially treating the dynamics of a material point with extensions of the theory to finite bodies. The fundamental differential equations of rectilinear motion are developed, and practical applications are found in the cases of falling bodies, upward throw and uniformly and variably accelerated bodies. Newton's laws are the basis of these latter items and also of the hypothetical "Engineers' Mass." The principles of harmonic motion are derived and discussed fully in connection with the Scotch Yoke, and the steam engine receives its preliminary introduction to the student. Colliding bodies receive attention in the discussion of the principles of impact.

Prerequisites: Mathematics, Courses I. II. III. IV. V. VI. and VII.
Machine Design, Courses I. II. III. and IV.

Texts: Church, *Mechanics of Engineering.*
Church, *Notes and Examples in Mechanics.*
Pierce, *Short Table of Integrals.*
Problem Sheets.
Cambria Steel.

Five hours per week during the first semester of the Junior year.

(Filkins, Allison.)

IV. TESTING LABORATORY.

This course acquaints the student with the difficulties attending the practical application of theory. It emphasizes systematic and logical presentation, shows the importance of small details, secures data for future use, and provides a criterion as to the value of a student in his profession. Tests are made to determine the strength and stiffness of building materials such as cast-iron, wrought-iron, steel, and wood in tension, compression, shearing, and flexure. Wire, wire-rope and cables are also investigated for strength. Stone and brick are examined for strength, absorption, disintegration, and other qualities which decide their economic values. The correct dimensioning and surfacing of specimens also forms an integral part of the course. Steel forms are submitted to the students for the determination of the centers of gravity and the moments of inertia. Written reports covering the apparatus, procedure, data, computation, results, and conclusions are required from each student. The tests upon different materials are discussed in independent articles written on standard size paper, eight and one-half inches by eleven inches, properly bound together and titled.

Prerequisite: This course must be taken in conjunction
with Course III.

Three hours per week during the first semester of the Junior year.

(Hazard.)

V. MECHANICS.

This course is an extension of Course III. Virtual velocities introduce the first elements of the principles of work and energy and serve as a basis of discussion in the treatment of the curvilinear motion of a material point which follows. Under this latter head the general equations and principles of curvilinear motion are derived and then applied to simple and cycloidal pendulums, to planetary motion, to a projectile in vacuo, to a body on smooth curved guide, and to absolute and relative velocities. For use in the motion of rigid bodies, the moments of inertia of the common geometrical solids are derived, after which the dynamics of rigid bodies are studied. The conceptions of equivalent and of equilibrating systems are involved in the study of rotating bodies, compound pendulums, rudimentary engines, fly-wheels, eccentric pulleys, rolling bodies, parallel rod of locomotive, hoisting in mines, and the like. Following these, the principles of work and energy are derived and emphasized in the study of problems involving fly-wheels and stationary engines, friction, dynamometers, belting, trains and locomotives, and hoisting apparatus. The course is concluded by a short reading in the graphics of mechanisms.

Prerequisites: Mechanics, Courses III. and IV.
Machine Design, Course V.

Texts: Church, *Mechanics of Engineering.*
Church, *Notes and Examples in Mechanics.*
Pierce, *Short Tables of Integrals.*
Problem Sheets.
Cambria Steel.

Three hours per week during the second semester of the Junior year.

(Filkins, Allison.)

VI. CONSTRUCTION.

In this course instruction is given in graphics, which involves a close study of the force triangle and polygons, pole, ray, special equilibrium polygon, resultant of forces, pier reactions, vertical dimensions of equilibrium polygons, together with applications to simple beams, centers of gravity, moments of inertia, articulated cranes, trusses, and gallows frames. The formulae for rigidity of frames are derived and applied to the various types of frames in planes and in space. The course also embraces the computation of loads to be borne by frames, from the weights of the parts and elements involved. The general forms of mill buildings are discussed and elementary ideas of ventilation, lighting, coverings, and the like are obtained.

Prerequisites: Mechanics, Courses III. and IV.

Texts: Ketchum, *Steel Mill Buildings.*
Jacoby, *Structural Details Plates.*
Filkins, *Mimeograph Notes on Wooden Construction.*

Lectures and recitations two hours per week and drafting three hours per week during the second semester of the Junior year.

(Filkins.)

VII. STRUCTURES.

This course is a study of the theory and practical design of wooden and steel structures. The student is instructed in the definitions and dimensions of parts such as housing, notching, mortise and tenon, dovetailing, lag-screws, dowels, lugs, keys, brace blocks, nuts, and washers. From accepted unit stresses for given materials, the student is led to design wooden fished or scarfed splices, and various joints. The design of the deepened beam is given to emphasize the relation between the stress couple and the vertical shear and also the distribution of shear in horizontal plane sections. The trussed beam as an important factor in construction receives due attention and is followed by a detailed design of a wooden roof truss, including roof covering, rafters, purlins, upper and lower chords, struts, tie-rods and miscellaneous joints, together with splices, corbels, anchorage, and laterals. Steel mill buildings are thoroughly discussed, and a complete design is required from each student. The student also receives instruction in masonry materials and construction.

Prerequisites: Courses III. IV. and VI.

Texts: Ketchum, *Steel Mill Buildings.*
Jacoby, *Structural Details Sheets.*
Filkins, *Mimeograph Notes on Wooden Structures and Masonry.*
Cambria Steel.

Recitations and lectures two hours and design six hours per week during the first semester of the Senior year.

(Filkins.)

VIII. CEMENT LABORATORY.

The intent of this course is to so familiarize the student with the properties of cement that he may not hesitate to utilize this material in his professional work. The laboratory also provides extensive opportunities for research and investigation. The course covers tests of natural and Portland cement and cement mortars for tensile, crushing, and transverse strength, adhesion, soundness, fineness, setting, freezing, and effect of chemicals. The course also embraces the mixing of cement into mortar and concrete.

Prerequisites: Mechanics, Courses III. and IV.

Texts: Seminary assignments to various works.

Three hours per week during the first semester of the Senior year, in connection with Course VIII.

(Filkins, Hazard.)

IX. HYDRAULICS AND HYDRAULIC MOTORS.

The course deals with the theory and practical application of the properties of fluids at rest and in motion, embracing hydrostatic pressure, manometers, strength of pipes, pressures in tanks and against walls and dams; immersion and flotation; steady flow of liquids through pipes and orifices and over weirs; fluid friction and losses of head; time of emptying vessels; steady flow of water in open channels and Kutter's formula; impulse and resistance of fluids; the Pelton water motor; overshot, breast and undershot water-wheels; backwater; theorem for flow in a revolving pipe; turbine and reaction wheels; theory of turbine testing.

Prerequisites: Courses III. IV. V. and VI.
Machine Design, Courses VI. and VII. or VIII.

Texts: Church, *Mechanics of Engineering.*
Church, *Notes on Hydraulic Motors.*

Two hours per week during the first semester of the Senior year.

(Filkins.)

X. HYDRAULIC LABORATORY.

Measurements are made of the flow over weirs, through orifices and through flumes and ditches. The determination of the approximate law of flow in pipes also forms part of the course. Water-wheels are tested and the efficiency of the hydraulic ram under various conditions is determined.

Arrangements have been made by which this department is to have the use of the city water supply for experimental work with wheels and nozzles. This will make available a head of about twelve hundred feet. With the supply available for a few hours' work, tests may be made on wheels developing over three hundred horse-power.

Prerequisite: This course can be taken only in conjunction with Course IX.

Three hours per week throughout the first semester of the Senior year, in connection with Course VI.

(Hazard.)

XI. ADVANCED MECHANICS.

This course is essentially for graduates, but may be taken by seniors who have the time. It consists of an application of graphics to the solution of masonry problems, including right arches of masonry, arch-ring, voussoirs, soffit, intrados, extrados, spandrel, crown, keystone, rise and span, mortar, friction, resultant and maximum pressure, true linear arch, load contour, symmetrical and non-symmetrical loadings on symmetrical arches, abutments and retaining walls, arch ribs, special equilibrium polygon, thrust, shear, moment, angular change and deflections; theorems of least work developed and applied to the above; graphical arithmetic; continuous rib free to slip on abutments; three-hinged rib; two-hinged rib; continuous rib with fixed ends; applications of Professor Eddy's Graphical Method; temperature and rid shortening; variable cross section; Scheffler's theory of the arch; continuous girders by graphics; Thatcher's concrete steel construction with variations; expanded metal and similar constructions; design of high masonry arched and gravity dams.

Prerequisites: Courses III. to X., inclusive.

Texts: Church, *Mechanics of Engineering.*
Baker, *Masonry Construction.*
Miscellaneous References.

Hours to be arranged.

(Filkins.)

XII. CONTRACTS AND SPECIFICATIONS.

This course is given to familiarize the student with the forms and the legality of contracts, together with the parties having power to make them and to carry them out. The student also becomes acquainted with the common forms of specifications. A synopsis of the law of contracts is first taken up, dealing with competency; the agreement and its legality; the consideration; sealed and parole contracts; assignment; construction; subsequent changes; discharge and remedies for breach of contract. This is followed by a study of engineering specifications and accompanying documents dwelling upon advertising, instructions to bidders, forms of proposals, general and specific clauses in engineering specifications, together with illustrative examples of complete contracts and specifications. Lectures by members of the legal and technical professions will also assist the student in more fully understanding the subject.

Prerequisite: The completion of all work preceding the second semester of the Senior year.

Text: Johnson, *Engineering Contracts and Specifications.*

Two hours per week during the second semester of the Senior year.

(Filkins.)

MACHINE DESIGN.

Professor Arthur Ransley Curtis.
Assistant Professor William Jonathan Hazard.
Instructor William George Haldane.
Instructor Gyula Bennett Manson.

In the drawing course stress is first laid upon the proper care and use of drawing instruments and drawing materials. Effort is made to see that the student acquires such habits of work as are in keeping with the best practice. Emphasis is first placed upon how to do good drawing rather than upon what is drawn. Again, as soon as the more advanced work is taken up, emphasis is transferred from simply making good drawings and placed on proper design. The student is led into this through a short series of sheets which show him the connection to be made between elementary drawing and descriptive geometry on the one hand and practical shop drawing on the other. All of the advanced drawing is based directly on and is a part of the work in machine design. The work in machine design is intended to acquaint the student with all forms of fastenings and other common devices used about machines and similar pieces of engineering, and more particularly all ways of transmitting motion and power, together with the correct methods for installation. Very little actual design of machines is undertaken, because students in the mining and metallurgical courses can best be served by being taught how to determine what is necessary and to select, install and run power-using apparatus in general, rather than by being taught their actual design. This, of course, does not apply to that part of drawing pertaining to metallurgical design.

I. MECHANICAL DRAWING.

The work begins with lectures on the selection and use of drawing instruments and other materials. It then leads through exercises to give the student the proper amount of skill involving the drawing of plane curves and figures. Following this comes tinting, shading with tints, line shading, mechanical and freehand lettering. The work on freehand lettering is begun early in the term and continued until the student is proficient.

Prerequisite: Entrance requirements.

Text: Curtis and Hazard, *Freshman Drawing Data.*

Six hours per week during the first semester of the Freshman year.

(Haldane, Manson.)

II. DESCRIPTIVE GEOMETRY.

The course begins with general definitions and the solution of the elementary problems relating to the point, to the right line, and to planes. Following these a general study is made of lines of single and double curvature, surfaces of single and double curvature, and warped surfaces. The solution of the tangent problems completes the work of the term.

Prerequisite: Entrance requirements.

Text: Church, *Descriptive Geometry and Shades and Shadows.*

Two hours per week during the first semester of the Freshman year.

(Curtis, Hazard, Haldane, Manson.)

III. MECHANICAL DRAWING.

The early work is based directly on the work in descriptive geometry involving varied problems in intersections. It then proceeds with work in shades and shadows in general and as applied to shaded lines for shop drawings, isometric and other mechanical perspectives, all drawn to scale and fully dimensioned. The last work is on regular shop drawings, rough sketches being given, from which accurate and complete working drawings are made.

Prerequisites: Courses I. and II.

Text: Curtis and Hazard, *Freshman Drawing Data.*

Nine hours per week during the second semester of the Freshman year.

(Haldane, Manson.)

IV. DESCRIPTIVE GEOMETRY AND SHADES AND SHADOWS.

This course is a continuation of Course II. The solution of problems relating to the intersections of surfaces is covered very thoroughly. This is followed by work in shades and shadows, with their application to shaded lines; isometric and other mechanical perspectives. Following the work on descriptive geometry proper there is a short series of lectures on the application of descriptive geometry methods to practical drawing and to such subjects as titles, borders, scales, lettering of drawings, necessary views, center and dimension lines.

Prerequisite: Course II.

Text: Church, *Descriptive Geometry and Shades and Shadows.*

Two hours per week during the second semester of the Freshman year.

(Curtis, Hazard, Haldane, Manson.)

V. MACHINE DESIGN. (MINING.)

As an introduction to the machine design proper, a study is first made of the different ways found in practice of communicating motion from one part to another without regard to the forces or stresses that may be involved. The methods investigated are the following: rigid and flexible connectors;

rolling cylinders and cones; toothed gearing, involute and cycloidal, spur and bevel; cams; link work; chain gearing and belting. Screws, nuts and bolts are first taken up, and then follow keys and cotters and cottered joints in general; pipes and pipe joints; standard fittings and expansion of pipes; riveted joints, stays and stayed surfaces.

The greater part of the work of this semester comes under the general head of fastenings. All proportions of parts are analyzed and tested by use of the mechanics of materials, and as far as is possible the student is made to see how by correct ways of working he can apply the principles and knowledge gained in this subject to the proper proportioning of machine parts in general. The work is given with the object always in view of making direct application in the drawing room. Freehand sketching to scale is also an integral part of the course.

Prerequisites: Courses I. II. III. and IV. This course must be preceded by or accompanied by Mechanics, Course III.

Text: Low and Bevis, *A Manual of Machine Design and Drawing.*

Two hours per week during the first semester of the Junior year.

(Curtis.)

VI. MACHINE DESIGN. (Mining.)

This is a continuation of the work of the first semester. The whole time is devoted to the different ways of transmitting power, together with the best methods of determining what is required for the same. A close study is first made of the forces and moments set up by the single elements of machines and also of the different ways of expressing the horsepower developed. Then follow shafting and shaft couplings, including work with combined bending and twisting, hollow and square shafts, proper spacing of bearings; belting, including different kinds of belts and belt fastenings and pulleys; cotton rope drives; wire rope drives; friction gearing, both spur and bevel; shrouding and other ways of affecting the strength of gears.

Prerequisite: Course V.

Text: Low and Bevis, *A Manual of Machine Drawing and Design.*

Two hours per week during the second semester of the Junior year.

(Curtis.)

VII. MACHINE DESIGN DRAWING. (Mining.)

The work in drawing depends directly upon the classroom work. As far as possible the data for the drawing are determined by calculations or such other considerations as are necessary in practical work. Care is also used to have the student shape up his sheets in accordance with the best drawing office practices. The drawing work of this term follows closely the work in the machine design for this term.

Prerequisites: Courses I. II. III. and IV. This course must be preceded by or accompanied by Course V.

Text: Data given.

Six hours per week during the first semester of the Junior year.

(Curtis.)

VIII. MACHINE DESIGN. (Metallurgical.)

The course in machine design for the metallurgical students has the same general outline as that for the mining students, but will be more of an empirical nature. The study will be more of engineering appliances as made than of their design.

Prerequisites: Courses I. II. III. and IV. This course must be preceded by or accompanied by Mechanics, Course III.

Text: Low and Bevis, *A Manual of Machine Drawing and Design.*

Two hours per week during the first semester of the Junior year.

IX. MACHINE DESIGN DRAWING. (Mining.)

This is a continuation of Course VII, and follows closely the classroom work in machine design for this term. The greater part of the time is consumed in the laying out, and in the design where necessary, of the complete power transmitting equipment for a mill or other plant involving the installation of all forms of mechanical apparatus for transmitting power.

Prerequisite: Course VII.

Text: Data given.

Six hours per week during the second semester of the Junior year.

(Curtis.)

X. MACHINE DESIGN DRAWING. (METALLURGICAL.)

The drawing for the students in metallurgy is of the same nature as that for the mining students, except that the application of the work of the classroom will be, as far as possible, in connection with machinery used in connection with metallurgical operations. Also more use is made of freehand sketches and similar work, and less stress is laid upon the making of completely finished drawings. The drawing that is done, however, is of the same quality as that done by the students in mining.

Prerequisite: Course VIII.

Text: Data given.

Three hours per week throughout the Junior year.

ELECTRICAL ENGINEERING.

ASSISTANT PROFESSOR WILLIAM JONATHAN HAZARD.

I. ELECTRIC POWER TRANSMISSION.

The object of this course is to familiarize the student with the practical applications of electricity and to enable him to make intelligent selection of apparatus found in the market which will best fulfil his requirements. It deals with the generation, measurement, transmission, and utilization of direct and alternating currents. The various systems of lighting are discussed. Direct and alternating current motors with their auxiliaries are studied in some detail to enable the user to adapt machines to altered conditions of use, where such changes are possible. Many problems are given to fix in the mind the principles studied. The course is given by text-book and lectures, supplemented by laboratory work and visits to various power plants.

Prerequisites: Physics, I. II. and III.

Text: Bell, *Electric Power Transmission.*

Two hours per week during the second semester of the Senior year.

(Hazard.)

II. ELECTRICAL LABORATORY.

This is the laboratory course accompanying Course I. It includes the measurement of the resistances of motors, finding the saturation curves, characteristic curves and efficiency of machines and determining the character and effectiveness of speed control of motors by several systems.

Prerequisites: Physics, I. II. and III.

One afternoon per week during the second semester of the Senior year.

(Hazard.)

III. STEAM LABORATORY.

This is a practical course in the use of the indicator, valve setting, testing of pressure gages, and the testing of engines, boilers and pumps.

Prerequisites: Physics, I. II. and III.

One afternoon per week during the second semester of the Senior year.

(Hazard.)

CHEMISTRY.

Professor Herman Fleck.
Instructor Charles Darwin Test.
Instructor John Christian Bailar.
Instructor Steve Howard Worrell.

The courses in chemistry are arranged especially for the needs of the mining and metallurgical engineer. The demands made upon chemistry by these branches of engineering require a broad knowledge of inorganic chemistry, of the theories underlying the science, and a close acquaintance with the properties of the elements, their reactions, detection, and separation.

I. GENERAL CHEMISTRY.

The course begins with a historical sketch of the development of the science of chemistry up to the atomic era. Thereafter history is introduced only as occasion demands. While the course rests on a structure of inorganic chemistry, the development and application of modern theories and of organic chemistry are taught as the work advances through the non-metallic elements during the first semester. Simultaneously a closer inspection of these elements is offered in the laboratory.

The second semester proceeds with the metals, which follow in the order of their periodicity, the periodic law having been previously expounded. Elementary metallurgy is introduced as the commercially important metals are considered.

Prerequisite: Entrance requirements.

Texts: Richter, *Inorganic Chemistry.*
Smith and Keller, *Experiments.*

Five hours per week throughout the Freshman year.

(Fleck.)

II. QUALITATIVE ANALYSIS.

This course begins with a short review in the laboratory of the non-metals. The student, equipped with a working knowledge of experimental manipulation, undertakes the study of the reactions of the bases and acids and their separation. Later more complex substances are given for analyses and the decomposition and solution, and examination of refractory substances follow.

Prerequisite: Entrance requirements.

Text: Medicus, *Qualitative Analysis*.

Lecture, one hour per week throughout the year.

Laboratory, nine hours per week during the first semester and six hours per week during the second semester of the Freshman year.

(Fleck, Bailar, Worrell.)

III. QUANTITATIVE ANALYSIS. (GRAVIMETRIC.)

The work begins with the analysis of simple salts. By this means the practice of manipulation and the observance of necessary precautions are learned. Gradually the analyses of substances of more complex nature are introduced in the form of salts and minerals. The various methods of decomposition and solution of refractory and complex material such as slags, mattes and alloys are practiced, and their constituents are determined by various methods.

Prerequisites: Courses I. and II.

Text: Cairns, *Quantitative Analysis*.

Lectures, one hour per week, laboratory nine hours per week, during the first semester of the Sophomore year.

(Fleck, Bailar, Worrell.)

IV. QUANTITATIVE ANALYSIS. (VOLUMETRIC.)

This course undertakes instruction in the use of standard solutions and a study of the reactions involved. In due time the methods commonly used in metallurgical industries are introduced. A knowledge of the preparation of standard solutions and their use is acquired by a course in acidimetry and alkalimetry. The preparation of standard solutions and their use in the wet assays of ores and products containing iron, manganeze, lead, zinc, copper, and other metals are practiced. Attention is given throughout to skill and speed of manipulation. One hour a week is devoted to the theory of quantitative analysis.

Prerequisites: Courses I. II. and III.

Text: Bailar, *Laboratory Notes.*

Lecture, one hour per week, laboratory nine hours per week, during the second semester of the Sophomore year.

(Fleck, Bailar, Worrell.)

V. TECHNICAL CHEMISTRY.

A broader acquaintance with industrial methods of chemistry, especially in the inorganic field, is an essential in the education of the engineer. The course is intended to supply this by illustrated lectures on chemistry applied to the arts and the apparatus used therein. Among the industries considered are: acids; alkalies; chlorine and its products; cements; coal and its products; petroleum; the electric furnace and its products, and the technical extraction of the less common elements. When possible, excursions are made to localities where such processes are in operation.

Prerequisites: Courses I. and II.

Lectures, two hours per week throughout the Sophomore year.

(Fleck.)

VI. METALLURGICAL CHEMISTRY.

This course, essentially a laboratory course, embraces work requiring skill, accuracy, and experience acquired in the preliminary courses. The student performs operations which bring him into touch with the products of less common metallurgical processes, and also acquires a good idea of chemical practice used in conjunction with common metallurgical operations which he himself performs or observes. Naturally this adds to the knowledge, speed, and accuracy expected of him in actual practice. Among the tasks imposed are the estimation of arsenic, antimony, bismuth, nickel, cobalt, mercury, cadmium, tin, the examination of electrolytic slimes, the application of previously acquired knowledge in checking actual metallurgical operations, especially with regard to perfection in speed and manipulation, and the study of electrolytic methods of analysis.

Prerequisites: Courses I. II. III. IV. and V.

Nine hours per week during the first semester of the Junior year.

(Fleck, Traphagen.)

PHYSICS.

ASSISTANT PROFESSOR EDSON RAY WOLCOTT.

In arranging the courses of this department the aim has been to make them as practical as possible, emphasizing those phenomena that bear directly on engineering problems, and yet not neglecting those facts which, though not so important of themselves, still are highly valuable in showing the close relationship that exists between physical laws. Special attention is given to problems involving the use of these laws, to actual demonstrations of their validity, and, as far as possible, to laboratory work verifying them quantitatively.

I. GENERAL PHYSICS.

This course consists of lectures, illustrated by experiment, and recitations with assigned problems. The subjects treated are as follows: mechanics, including the elements of kinematics, dynamics and hydrostatics; the properties of matter; heat, including thermometry and expansion, calorimetry, change of state, conduction, radiation, and the elements of thermodynamics; sound, including wave motion in general, production and propagation of sound waves, pitch, reflection, refraction, interference and resonance.

Prerequisites: Mathematics, Courses I. II. III. and V.

Text: Watson, *A Text-Book of Physics.*

Three lectures and one recitation per week during the first semester of the Sophomore year.

(Wolcott.)

II. GENERAL PHYSICS.

This course is a continuation of Course I. The subjects treated are as follows: light, including propagation, reflection, refraction, dispersion, interference, emission, absorption, and polarization; electricity and magnetism, including electro-statics, electro-kinematics, thermo-electricity, magnetic induction, electro-magnetism, electrolysis, the electro-magnetic theory, and electric oscillations.

Prerequisite: Course I.

Text: Watson, *A Text-Book of Physics.*

Three lectures and one recitation per week during the second semester of the Sophomore year.

(Wolcott.)

III. PHYSICAL LABORATORY.

This course is arranged to accompany Courses I and II. Its aim is to teach the student the necessity of careful work as well as to acquire skill in physical measurement so that the important physical laws can be quantitatively verified.

Prerequisites: Mathematics, Courses I. II. III. and IV.
Physics, Courses I. and II. taken in conjunction with this course.

Text: Ames and Bliss, *A Manual of Experiments in Physics.*

Three hours per week throughout the year.

(Wolcott.)

MATHEMATICS.

President Victor Clifton Alderson.
Professor Charles Roland Burger.
Instructor William George Haldane.
Instructor John Joseph Browne.

The courses in this department have been arranged to meet the extensive needs of students in the various branches of engineering. The subjects are treated so as to give the student both logical training and power of application. The principles which are of greatest value in engineering work are particularly emphasized. The courses offered serve as a sufficient prerequisite for the work in mathematical physics, physical chemistry, engineering and applied mechanics; and they mark the minimum of mathematical attainments that an engineer ought to possess. A special feature of the work is the early introduction of the calculus. By this means the principles of this subject are allowed to develop slowly, their sphere of usefulness is widened, and the student is able, early in the course, to make direct application of his knowledge of mathematics to practical problems.

I. COLLEGE ALGEBRA.

The course begins with a comprehensive treatment of quadratics. Graphic representation of equations, discussion of elementary problems on maxima and minima, and the application of algebra to analytic geometry are introduced. The progressions and other series, variation, binomial theorem for any index, partial fractions, exponentials, logarithms, expansion of functions in series, and the most useful propositions in the theory of equations receive thorough treatment.

Prerequisite: Entrance requirements.

Text: Wells, *Advanced Course in Algebra.*

Five hours per week during the first semester of the Freshman year.

(Burger, Browne.)

II. TRIGONOMETRY AND DETERMINANTS.

The general formulae of trigonometry are developed. The subject includes practice in the use of logarithmic tables and the application of trigonometry to mensuration in general. Emphasis is given to the graphic representation of trigonometric, inverse trigonometric, and hyperbolic functions; to the recognition of the rigorous ideas of modern mathematics in dealing with the fundamental series of trigonometry, and to the natural treatment of the complex number and the hyperbolic functions. The elementary properties of Determinants are also considered.

Prérequisite: Entrance requirements.

Texts: Wells, *Complete Trigonometry.*
Jones, *Logarithmic Tables.*

Three hours per week during the first semester of the Freshman year.

(Alderson, Burger, Haldane.)

III. ELEMENTS OF ANALYSIS.

This is a practical course in advanced algebra and in the elements of the differential calculus. The language, the symbols and the first processes of infinitesimal calculus, both in the pure and applied form, are explained. Many illustrations in geometry, physics, engineering, and applied mechanics are introduced. The fundamental principles of continuity, limiting values, theory of infinitesimals, and the differentiation of the elementary forms are established. Application is made to problems involving maxima and minima, rates, and to theorems in coördinate geometry. Many simple problems are frequently assigned to acquaint the student with the fundamental operations of the calculus.

Prerequisites: Courses I. and II.

Text: Murray, *First Course in Infinitesimal Calculus.*

Three hours per week during the second semester of the Freshman year.

(Alderson, Burger, Haldane.)

IV. COÖRDINATE GEOMETRY.

The analytic geometry of the straight line, circle and conic sections, including a discussion of the general equation of the second degree, is amply treated. Methods of the calculus are introduced. In the solid analytic geometry, besides the plane and the straight line, the cylinders and the surfaces of revolution are treated, and all the quadric surfaces are studied from the simplest forms of their equations.

Prerequisites: Courses I. and II.

Text: Bailey and Woods, *Analytic Geometry.*

Five hours per week during the second semester of the Freshman year.

(Burger, Browne.)

V. DIFFERENTIAL AND INTEGRAL CALCULUS.

This course is a continuation of Course III, in which students are made familiar with the ordinary processes and applications of the calculus. A principal feature of this subject consists in carrying on the development of the differential and of the integral calculus together. This method of instruction enables the student to grasp the more difficult notions of the subject in their inherent relations, and at the same time to apply this knowledge, early in the course, to the solution of engineering problems.

Prerequisites: Courses I. II. III. and IV.

Text: Murray, *First Course in Infinitesimal Calculus.*

Five hours per week during the first semester of the Sophomore year.

(Burger, Browne.)

VI. INTEGRAL CALCULUS.

This course is a continuation of Course V. The notion of a definite integral is stated in its fundamental and most comprehensive form. The aim is to make clear the *rationale* of each process, and to encourage the student to become independent of formulæ of integration. The theory of single and multiple integration is applied to the principal methods of rectification and quadrature, and to the calculation of the surfaces and volumes of solids of revolution. The student is also given many useful and practical applications of the integral calculus. These include the general method to be employed in obtaining the position of a centroid, the value of a moment of inertia, and other practical problems in physics, engineering, and applied mechanics.

Prerequisites: Courses I. II. III. IV. and V.

Text: Murray, *First Course in Infinitesimal Calculus.*

Three hours per week during the second semester of the Sophomore year.

(Burger, Browne.)

VII. DIFFERENTIAL EQUATIONS.

Prominence is given in this subject to the geometrical illustrations which arise when the variables are regarded as the rectangular coördinates of a point. For the sake of students in engineering, who wish to use differential equations as a tool, and have little time to devote to general theory, the theoretical explanations are made as brief as is consistent with clearness and sound reasoning. Practical applications dealing with geometrical, physical, and mechanical problems are constantly kept in mind.

Prerequisites: Courses I. II. III. IV. V. and VI.

Text: Murray, *Differential Equations.*

Two hours per week during the second semester of the Sophomore year.

(Burger, Browne.)

MATHEMATICAL SEMINAR.

Conferences are held from time to time, by members of the departments of pure and applied mathematics, for the discussion of questions related to their respective subjects. Members report on noteworthy articles in current journals, and on the results of reading and investigation.

BUILDINGS.

Main Building. This is a continuous group of brick structures, including the buildings of 1880, of 1882, and of 1890. The first two are practically thrown together, and with one large and one small laboratory, three private laboratories, stock room, two balance rooms, and two lecture rooms, accommodate chiefly the students in chemistry. In the basement of the building of 1882 are the cement and testing laboratories. In the building of 1890 are located the President's office, the Registrar's office, the library, and the geological cabinet and lecture room. On the second floor are lecture rooms for mathematics, two private offices, a geological work room, and a geological cabinet. The third floor is devoted to the Freshman drafting room, and the basement to the temporary heating plant, the gymnasium lockers, the bathrooms, and the gymnasium. The total floor space of the buildings of 1880, 1882, and 1890 is forty thousand square feet.

HALL OF ENGINEERING. This building, constructed of red pressed brick, consists of two floors and a basement, and was completed in the fall of 1894. The upper floor contains the Junior and Sophomore drafting rooms, the blue print room, and a private office. The physics lecture and apparatus room, the photometry room, the physical laboratory, the balance room, and the apparatus rooms, as well as the private office, occupy the first floor. The basement contains the dynamo and the engine room, three electrical laboratories, a battery and switchboard room, and a small shop. The floor space is eleven thousand square feet.

ASSAY BUILDING. This building, completed in the fall of 1900, is devoted entirely to assaying. It is a brick structure, forty-six by ninety-two feet, without cellar, and is well equipped with offices, balance, store, and parting rooms. There are thirty-two large muffle furnaces, each with its work desk and coal bin. This structure, which is one of the most perfect of its kind in the world, was erected by a gift from the late W. S. Stratton.

STRATTON HALL. The corner stone of this building was laid by the A. F. & A. M. of Colorado, on November 20. 1902, and was completed in January, 1904. The basement wall and first story are of Lyons sandstone, in broken ashlar, topped by a story of gray Golden brick. The building is finished on the interior with red pressed brick, and little wood is used, except that in the floors and staircases. The basement accommodates the metallurgical laboratories. The first floor contains two large lecture rooms, each with apparatus room and private office for metallurgy and mining. The second floor, in one-half, accommodates the surveying and mechanics in one large lecture room, with apparatus room and private office, and in the other half a drafting room. The third floor is devoted entirely to a large drafting room for the Senior class. The structure was named in honor of the late W. S. Stratton, whose gift of twenty-five thousand dollars made this building possible.

RESIDENCE OF THE PRESIDENT. This is a brick building of two and one-half stories. It was built in 1888.

CARPENTER SHOP. This is well equipped for the special demands which are continually arising in a technical school. The work varies from ordinary repair work to the careful construction of special apparatus needed in the various departments of the school.

MACHINE SHOP. What has been said of the carpenter shop is equally true of the machine shop. It is imperative that the school have one of its own, in order to keep its mechanical apparatus in proper working order, as well as to construct such apparatus as is necessary to carry on any new or original work. The machines of both shops are driven by direct connected motors. Both shops are fully equipped with the necessary benches and hand tools. They occupy a building sixteen by fifty feet, in addition to the storeroom for lumber.

BOILER HOUSE. This building contains an eighty horsepower fire-tube boiler, the Sturtevant fan and engine for heating Engineering Hall, and the necessary receiving tanks, feed pumps, and auxiliaries of a power plant.

LABORATORIES AND EQUIPMENT.

MINERALOGICAL AND GEOLOGICAL LABORATORY AND CABINET.

Under the name cabinet is embraced not only the distinctively display collections, which may perhaps be called the cabinet proper, but also the other collections that have been prepared mainly for the purpose of class instruction. These collections are necessarily changing rapidly from year to year, as new material is constantly being added. This new material is obtained partly by purchase, but mainly by direct collecting, and by means of exchange with other institutions. The display collections are not classified systematically, but are arranged in different cases with a view to displaying certain groups of minerals or minerals from certain localities. The display collections are to be found in flat glass-topped cases and the other collections in cases of drawers.

Among the more interesting displays are quartz and microcline crystals from Florissant, Colo.; golden calcites from Joplin, Mo.; fluorite and barite from England; epidote crystals from Alaska; pyroxene, epidote, and magnetite crystals from Salida, Colo.; sphalerite crystals from Kokomo, Colo.; pyrite crystals from Gilpin county, Colo.; crystallized sulphur from Sicily; dolomite and calcite from Ouray County, Colo.; geyserite from the Yellowstone National Park, and, above all, several cases of zeolites (thomsonite, mesolite, analcite, chabazite), from North Table Mountain, Golden, Colo. The case of mesolites is unique as well as beautiful, as it cannot be duplicated by any cabinet in the world.

The various collections are classified as follows:

First. *A Mineral Type Collection*, consisting of well-characterized specimens to be used by the students for the purpose of study and comparison. This collection at present contains specimens representing two hundred seventeen species and sixty-one additional varieties. These specimens come from many countries, but Colorado minerals are especially well represented.

Second. *A Display Collection,* mainly of large and fine specimens of minerals and rocks. Many graduates and mining men, friends of the institution, have contributed gifts to this collection.

Third. *A Supplementary Collection,* containing the rarer and more expensive minerals not placed in one of the above mentioned collections.

Fourth. *A Descriptive Collection,* illustrative of the terms used in describing the various structural, physical, optical and other properties of minerals.

Fifth. *A Student's Working Collection of Minerals,* consisting of over twenty thousand unlabeled specimens, similar to those in the type collection, to be used by the student for study and determination.

Sixth. *A Crystal Collection,* consisting of natural crystals to be used in the determination of crystal forms.

Seventh. *A Crystal Model Collection,* containing a large number of glass and wooden models used in the study of crystallography.

Eighth. *A Blow-Pipe Collection,* containing materials used in blow-piping.

Ninth. *Rock Type Collection,* containing (a) a collection of rocks from different countries of the world; (b) a series of Colorado rocks; (c) various rocks illustrative of structural features.

Tenth. *A Working Rock Collection,* containing miscellaneous unlabeled rocks, to be used by students in connection with the study of lithology.

Eleventh. *A Collection of Fossils,* to be used in connection with the course in historical geology.

Twelfth. The United States Geological Survey Educational Series of Rocks.

Thirteenth. Professor Patton's private collection of minerals.

Fourteenth. Professor Patton's private collection of rocks.

SUMMARY OF COLLECTIONS.

Type Collection of Minerals	3,700
Working Collection of Minerals (about)	21,000
Display Collection of Minerals	1,305
Supplementary Collection of Minerals	950
Crystal Collection	1,800
Display Collection of Fossils	342
Miscellaneous Collection of Fossils	1,360
Type Collection of Rocks	1,800
Working Collection of Rocks	7,408
United States Geological Survey Educational Series of Rocks	156
Professor Patton's Collection of Rocks	1,700
Professor Patton's Collection of Minerals	970
Summary of specimens	42,491

EXCHANGES.

The college has prepared a printed list of exchange material, covering both minerals and rocks. The list will be sent to all who wish to arrange for exchanges. Correspondents should state what material they are prepared to offer in exchange, and letters should be addressed to Professor H. B. Patton, Golden, Colo.

CHEMICAL LABORATORIES.

The chemical laboratories, lecture rooms and equipment of the department of chemistry occupy almost all of the space of the buildings of 1880-1882. The main laboratory is situated on the first floor of the buildings mentioned, which have been thrown together for the purpose, yielding a working space of three thousand eight hundred forty-four square feet. It is equipped with especially designed tile topped desks of oak, provided with low reagent shelves, gas, water and filtering apparatus. This laboratory will accommodate one hundred twenty-eight students at one time. There is ample light and ventilation, and the numerous hoods, arranged along the walls at the ends of each row of desks, are connected with a large Sturtevant blower, which discharges from a high brick stack. The tiled hoods are also fitted with gas attachments, and a number are fitted with connections for supplying hydrogen sulphide gas to the laboratory from a large generator which is situated in a separate compartment outside the building. There are on this floor, in connection with the main laboratory, the issue room for supplies, two private laboratories, and a balance room equipped with standard Sartorius balances.

On the second floor of the building of 1880 is a laboratory of one thousand five hundred thirty-two square feet, provided with suitable light, heat, and ventilation. It will accommodate fifty-six students. There are also a balance room and a private laboratory in connection with this department. The chemical lecture room is on the second floor of the building of 1882, and has a seating capacity of about one hundred twenty. A long lecture table for experimental work, a projection lantern connected with the storage battery, screen, complete the equipment of this lecture room. The two issue rooms and the store rooms in the basement are stocked with a supply of apparatus and chemicals for general use, and also with apparatus designed for use in the more advanced courses. A gas machine room in the basement supplies the gas for laboratory use from a 300-light Detroit Gas Machine, which is connected with buried supply tanks outside of the building.

PHYSICAL LABORATORIES.

The physical laboratory is located on the first floor and basement of the Hall of Engineering, and includes, besides the lecture room and general laboratory, several special rooms fitted up with heavy piers for advanced work. The equipment is arranged especially for the instruction of students of engineering, and includes, besides the ordinary demonstration and laboratory apparatus, a Kater pendulum, a Parr coal calorimeter, electrical apparatus for the determination of the mechanical equivalent of heat and the expansion of metals, and a complete Lummer-Brodhun photometer. The electrical laboratories are well equipped with galvanometers, standard resistances, condensers, ammeters, voltmeters, dynamometers, permeameters, standard cells, a Kelvin balance, and special apparatus for practice in electrolysis.

STEAM LABORATORY.

The tubular boiler and high speed automatic engine which are in use at present for power, are also used for testing purposes. There is also a fifteen horse-power throttling engine, and a small slide valve engine, which is used chiefly in illustrating valve setting. Seven pumps are included in the equipment. The laboratory is provided with continuous counters, recording counters, indicators, gages, gage testers, steam calorimeters, measuring tanks, and scales.

ELECTRICAL LABORATORY.

This laboratory is equipped with standard voltmeters and ammeters, inductive and non-inductive resistances for artificial loads, and a number of transformers. About twenty generators and motors are in use or available about the college for testing purposes. A new "Chloride Accumulator" of fifty-four cells has been added to the equipment this year. This doubles the battery capacity and greatly improves the current supply for instrument testing, photometry, and all work to which a battery is especially adapted.

ASSAY LABORATORY.

Through the generosity of the late W. S. Stratton, of Colorado Springs, the Board of Trustees has recently completed a building forty-six by ninety-two feet, which is devoted entirely to assaying. This building is well equipped with parting, balance and store rooms and office, and has at present thirty-two coal-fired muffle furnaces, with space for sixteen more. Each student has his own muffle, with his own coal bin, pulp balance, and desk room, conveniently arranged with regard to his furnace; he also has access in the balance room to the best assay balances to be obtained on the market. In addition to the use of coal-fired furnaces, the student is instructed in the use of gasoline furnaces, two varieties of which are in the laboratory.

METALLURGICAL LABORATORY.

The college has the advantage of a fine collection of models from the works of Theodore Gersdorf, Freiberg, Saxony, illustrating the best type of furnaces in this and other countries. Each model is made to a scale and is complete in every detail. A handsome addition to these models has come from the liberality of Mr. John W. Nesmith, President of the Colorado Iron Works. It includes:

Working model of twenty-stamp mill, on scale of one and one-half inches to the foot.

Working model of ore rolls, same scale.

Working model of a Dodge crusher.

Model of modern blast furnace for lead-silver ores, with water-jacket.

In addition to the above there are a large number of smaller models, such as the completed set used in the famous Keyes and Arents lead-well suit.

There is a collection of ores and metallurgical products which is constantly being augmented. The laboratory also contains machinery for amalgamating, chlorination, and cyanidation of ores.

ORE DRESSING LABORATORY.

Besides taking full advantage of the location of the college for the practical study of ore dressing, the college has considerable apparatus for experimental work on both the small and the large scale. This includes crushing machines of several types, classifiers, slime tables, jigs, and concentration tables.

TESTING LABORATORY.

The laboratory is provided with a 100,000-pound Riehle testing machine arranged for experiments in tension, compression, shearing, and flexure of materials of construction. Extensometers for measuring elongations, and electrical contact micrometers for measuring deflections and compressions, are employed. Simplified apparatus for testing columns of small dimensions and beams in flexure is being prepared. Numerous steel sections provide useful problems in determining centers of gravity and moments of inertia.

CEMENT LABORATORY.

The apparatus in this laboratory consists of a 1,200-pound Riehle testing machine for testing briquettes in tension. A nest of sand sieves gages the sand used in tests. Scales and volumeters are provided for measuring quantities in bulk. The specific gravity of cement is determined by means of Le Chatelier apparatus. A nest of fineness sieves and a very sensitive set of scales, equip the student for the fineness test. Setting is determined by means of the complete Vicat apparatus. Trowels, spatulas, large slate mixing boards, beakers, moulds, and immersing vats, provide apparatus for the making and setting of briquettes and for the soundness tests. Glass baths for chemical tests, trays for heaviness tests, and other general facilities, permit the most extensive tests and investigations.

MINING EQUIPMENT.

The mining equipment consists of models, maps, photographs, and lantern slides, illustrating mines and mining operations; safety lamps; instruments for measuring ventilation; an explosive tester; an electric firing apparatus, and models of timbering. The character of material mined is shown by an extensive collection of ores and rocks. Models of machinery and appliances, samples of rope, valves and injectors, supplement the college power plant in illustrating the essentials of mine plants. Numerous reports on mines and plants have been collected to illustrate the practice of engineers and the economy in the operation of power machinery.

SURVEYING EQUIPMENT.

The equipment of the department of surveying is well adapted to the practical course given. Students are organized into parties for field work. Each party is assigned a locker containing steel measuring tapes, marking pins, hatchet, plumb bob, and other essentials. For transit work there are six light mountain transits, all of which are provided with solar attachments for determining the meridian and latitude and four of them are provided with auxiliary telescopes for underground work. There are also two heavy transits, one of which is of English make.

For leveling, six wye levels of standard manufacture are used. The department is well supplied with leveling rods of various makes and types, stadia rods, hand levels, clinometers, flagpoles, and other accessories.

The instruments noted above are manufactured by such well-known firms as C. L. Berger and Sons, Heller and Brightly, W. and L. E. Gurley, Keufel and Esser, Young and Sons, and Negretti and Zambra (English). Additions are constantly being made, keeping pace with the growth of the school and replacing worn-out instruments.

DRAWING ROOMS.

FRESHMAN. This occupies the whole of the top floor of the main building. The floor area is about four thousand square feet. It is lighted by windows on the north, east, and west, and by eight large skylights in the roof. A suitable office for the instructors is located in a central position, in which all drawings are filed and all records kept. Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The present equipment will accommodate about one hundred twenty-five students.

JUNIOR. The second floor of the Hall of Engineering is used for the Junior drawing, in connection with the subject of mechanism and machine design. There are two drawing rooms, each twenty-seven by fifty feet. They are lighted by windows on three sides and by skylights. Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The tables are independent of each other and are adjustable. The present equipment accommodates about seventy-five students. There is a blue print room fully equipped with an adjustable printing frame and all other necessary appliances; also an office for the instructor, where all drawings and records are filed.

SENIOR. The drafting of the Senior year is given in the drafting room on the second floor of Stratton Hall.

EXPENSES.

TUITION.

The Statutes of Colorado provide as follows:

> "The said School of Mines shall be open and free for instruction to all bona fide residents of this State, without regard to sex or color, and, with the consent of the Board, students from other states and territories may receive education thereat upon such terms and at such rates of tuition as the Board may prescribe."

The tuition for non-residents is one hundred dollars per year. This is payable in two instalments—fifty dollars at the beginning of each semester.

FEES AND DEPOSITS.

Deposits are required to cover the cost of supplies consumed, and any unused balance is returned. Fees are charged to cover not only the cost of materials furnished, but also the wear on apparatus and supplies. No part of a fee is returnable.

Matriculation Fee (Paid once only)	$5.00
Locker Deposit (Paid once only)	1.00
Drawing Deposit (Paid once only)	2.00

FRESHMAN YEAR.

First Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Qualitative Analysis Fee	20.00
Qualitative Analysis Deposit	15.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Qualitative Analysis Fee	20.00
Surveying Fee	5.00

SOPHOMORE YEAR.

First Semester.

Athletic Fee	$ 5.00
Quantitative Analysis Fee	10.00
Quantitative Analysis Deposit	15.00
Mineralogy and Blowpipe Fee	15.00
Physics Laboratory Fee	3.00

Second Semester.

Athletic Fee	$ 5.00
Quantitative Analysis Fee	10.00
Physics Laboratory Fee	3.00
Surveying Fee	5.00

JUNIOR YEAR.

First Semester.

Athletic Fee	$ 5.00
Quantitative Analysis Fee (Metallurgical Engineering only)	10.00
Drawing Fee	.50
Testing Laboratory Fee	2.00
Assaying Deposit (Mining Engineering only)	25.00
Assaying Fee (Mining Engineering only)	20.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Assaying Deposit (Metallurgical Engineering only)	25.00
Assaying Fee (Metallurgical Engineering only)	20.00

SENIOR YEAR.

First Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Ore Dressing Fee	5.00
Ore Dressing Deposit	10.00
Electro-Metallurgy Lab. Fee (Metallurgical Engineering only)	3.00
Hydraulic Laboratory Fee	2.00
Cement Laboratory Fee	2.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Electrical Laboratory Fee	2.00
Metallurgical Laboratory Fee (Metallurgical Engineering only)	5.00
Metallurgical Laboratory Deposit (Metallurgical Engineering only)	10.00
Metallurgical Practice Fee (Mining Engineering only)	5.00
Metallurgical Practice Fee (Metallurgical Engineering only)	10.00
Steam Laboratory Fee (Mining Engineering only)	2.00
Graduation Fee	6.00

TEXT BOOKS AND STUDENT SUPPLIES.

The cost of text-books and students' supplies necessarily varies, but the following is a fair estimate:

Freshman Year:	Text-Books	$15.00
	Drawing Supplies	20.00
Sophomore Year:	Text-Books	15.00
Junior Year:	Text-Books	35.00
Senior Year:	Text-Books	17.50

BOARD AND LODGING.

The college has no dormitory. Board can be obtained in private families at from four dollars to six dollars per week. Students' clubs furnish board at about fourteen dollars per month. Rooms can be obtained from six dollars to twelve dollars per month.

OTHER EXPENSES.

There are other expenses incidental to the mining, metallurgical, and geological trips, which vary so widely that they cannot be estimated. The preparation of the Senior theses also involves expenses which vary with the nature and treatment of the subjects. For laboratory work in special cases a deposit of fifteen dollars is required. Students leaving in mid-term, except on account of severe protracted sickness, are not entitled to the return of fees or tuition. All charges of the college are payable strictly in advance. No student is allowed to be graduated while indebted to the school. The Trustees reserve the right to make incidental charges in fees and deposits without printed notice, as new and unforeseen emergencies may arise.

Students who desire to earn money to defray their college expenses are advised to limit their work to the summer vacation. The course of study is too exacting to allow much time during the college year for outside work.

The total expenses of the college year, exclusive of tuition, need not exceed four hundred dollars, and may, by strict economy, be considerably reduced.

GENERAL INFORMATION.

ATHLETIC ASSOCIATION.

By virtue of the athletic fee required all students regularly entering the School of Mines become members of the Athletic Association. The affairs of the association are managed by eight directors elected by the students, two from each class, and by the Faculty Committee on Athletics.

All matters involving expenditure of money are passed upon by both bodies so as to assure economy of management. In most matters the Faculty Committee serves as an advisory committee, the responsibility and initiative being left as far as possible in the hands of the student directors.

The association is supported by the students' fees, by gate receipts, and by contributions from the alumni and other friends of the college. All funds are in the hands of the treasurer, who, by resolution of the Board of Trustees, must be one of the Faculty Committee on Athletics.

Officers.

Leroy L. Middelcamp, '05, President.
George C. Ripley, '06, Secretary.
Professor H. B. Patton, Treasurer.

Directors.

Class of '05.
LEROY L. MIDDELCAMP.
JOHN J. CORY.
Class of '06.
GEORGE C. RIPLEY.
TIFFANY STEPHENSON.
Class of '07.
H. D. WHITEHOUSE.
ALLAN PATTERSON.
Class of '08.
JOHN CULBERTSON.
MAURICE HOYT.

GYMNASIUM.

The gymnasium is a valuable adjunct to the school equipment. It is in the basement of the building of 1890, its floor (sixty-five by forty feet) permitting drill exercise with ample space for apparatus, while its height of twenty feet allows the use of swinging appliances and perfect ventilation. Around the walls are pulley weights of every description, while among the other instruments are swinging rings, parallel bars, horse buck, quarter circle, "cage" with apparatus for development of every set of muscles, ladders, spring board, complete sets of clubs and dumb-bells, and many other pieces.

The gymnasium is open every school afternoon, and till seven o'clock evenings. Hot and cold shower baths adjoin the gymnasium. Each student pays a fee of ten dollars a year to the Athletic Association and deposits one dollar for his locker.

The gymnasium is managed by the School of Mines Athletic Association, composed of officers and students of the institution.

LIBRARY.

The Colorado School of Mines library numbers about seven thousand five hundred volumes and four thousand pamphlets, selected with special reference to the instruction here given. Students and faculty are allowed free access to shelves, and may draw books, which are not reserved for a special purpose, for home use. The card catalogue, which is arranged on the dictionary plan, is an adaptation of the Dewey decimal system to the needs of a technical library.

The library receives the publications of the leading scientific societies of the world, and the chief literary and scientific periodicals. It is especially rich in files of journals relating to the various branches of mining engineering, and receives as gifts the maps and various publications of the United States Geological Survey, a number of other United States documents, and reports of various state geological surveys and mining bureaus.

The library is open from 8 to 12 a. m., 1 to 5 p. m., and 7 to 10 p. m., with the exception of Sundays and legal holidays.

METHODS OF GRADING.

The following system of grading is used:

A=Excellent.
B=Good.
C=Fair.
D=Conditioned.
E=Failed.

A, B and C are passing grades.

D (Conditioned) means that the student is not passed. The deficiency may be removed by passing an examination or otherwise completing his work. Unless a condition is removed before the beginning of the school year following the year in which the condition is given, it becomes an E, and the subject must be taken again in class.

E (Failed) means that the subject must be taken again in class, and no advanced subject which depends on this one can be taken until the E is removed.

HONOR SYSTEM.

By the action of the student body on May 27, 1904, a Constitution was adopted and the Honor System inaugurated. The Constitution was approved by the Faculty June 4, 1904. The object of this movement is to place in the hands of a

Senate elected by the students, the trial, and the recommendation for punishment, of any student detected in unfair practices in his school work. The Senate is composed of the following students:

CLASS OF 1905.

Arthur F. Hewitt.
William E. Ryan.
George B. Rice.
Alternate, Arthur T. Thomson.

CLASS OF 1906.

Ernest E. Thum.
Wayne S. Kell.
Tiffany Stephenson.
Alternate, William G. Dow.

CLASS OF 1907.

William W. Blackburn.
Theodore W. Quayle.
Howard C. Armington.
Alternate, William M. Johnston.

CLASS OF 1908.

John T. Boyd.
L. P. Curtis.
William R. Kilgore.
Alternate, John V. Hubbard.

COLLEGE Y. M. C. A.

The Young Men's Christian Association is represented in the college by a branch organization which maintains a reading room in the center of the city. This room is open Friday and Saturday evenings for social purposes. An effort is made to receive incoming students and to assist them in finding rooms and board. They are encouraged to form high standards of Christian character and are helped maintain such standards. A reception at the opening of the college year gives new men an opportunity to meet faculty and students in a social way. A hand book of information is issued annually by the Association, and can be obtained on application to the corresponding secretary.

The officers are:

A. C. Terrill, President.
W. S. Kell, Vice President.
D. Muir, Treasurer.
C. M. Rath, Recording Secretary.
C. L. Colburn, Corresponding Secretary.

SCIENTIFIC SOCIETY.

The Scientific Society of the Colorado School of Mines has for its object the presentation and discussion of technical and engineering subjects. Original papers are prepared and read before the society by its active members. The editorial staff has in operation a comprehensive system for the review of current technical literature and the bringing before the society of the noteworthy and salient questions of the day. The addressing of an assembly by the students insures the stimulation of confidence, which is so essential to the technical and professional man in his career. From time to time lectures are delivered before the society by the leading authorities on various topics of primary interest to its members and friends. The proceedings of the society are printed in its official publication, "The Bulletin," which is issued twice during the school year. The Alumni, Faculty, Senior and Junior classes of the college constitute the active members of the organization, while the Sophomores and Freshmen are associates.

Meetings are held at least once a month, often more frequently, in the Hall of Engineering.

Officers for the year 1904-05 are as follows:

Fred C. Carstarphen, President.
Wm. J. Hallett, Vice President.
Geo. B. Putnam, Secretary.
Arthur C. Terrill, Treasurer.
Arthur T. Thompson. Manager of the Bulletin.
Julius Hornbein, Editor of the Bulletin.

SPANISH.

In response to the demand from students who expect to pursue their vocation in Mexico, a private class in Spanish is conducted by Mr. Evaristo Parades, a native of Mexico and a student of the college, and by Mr. H. R. Van Wagenen.

GIFTS TO THE COLLEGE.

C. M. Fueller, E. M., Denver, Colo.
Plans of two recent cyanide mills and the preliminary plan of a 500-ton concentration plant.

United States Colortype Company, Denver, Colo.
Pictures illustrating Color Photography.

Mr. George S. Clason, Denver, Colo.
Maps of
San Juan Triangle,
Gunnison County,
North Gilpin County,
Grand County,
Larimer County,
The Gregory-Buell Consolidated Gold Mining & Milling Company's properties.

Denver Gas and Electric Company, Denver, Colo.
Four 40-light Westinghouse transformers.

Capt. E. L. Berthoud, Golden, Colo.
Map of
South Africa, and
Geological Map of France.

Mr. James Underhill, Idaho Springs, Colo.
Maps of Lower Clear Creek and Gilpin Counties, showing mining claims in the vicinity of Idaho Springs.

Cambria Steel Company, Johnstown, Pa.
Set of steel sections, rivets, and bolts.

Sullivan Machine Company, Chicago, Ill.
Pictures of four-stage air compressor.

Colorado & Southern Railway Company.
Pictures of Clear Creek Canon.

Colorado Midland Railway Company.
Pictures of Hagerman Pass and other points in the Rocky Mountains.

Pennsylvania, New York and Long Island R. R. Co.
Specifications and contract drawings.

Stearns-Rogers Manufacturing Company, Denver, Colo.
Pictures of machinery.

Mine and Smelter Supply Company, Denver, Colo.
Thirty-one drawings of mining and metallurgical machinery.

Colorado Portland Cement Company, Denver, Colo.
Barrel of cement for Cement Laboratory.

Boston and Montana Consolidated Copper and Silver Mining Company.

A full set of specimens illustrating the metallurgy of the sulphide ores of copper.

Butte and Boston Consolidated Mining Company.
Four hundred samples of gold and silver bearing ores and furnace products for assaying.

American Smelting and Refining Company.
One thousand pulp samples of gold, silver, and copper ores for assaying.

Duplex Hanger Co., Cleveland, Ohio.
Samples of hangers and wall plates.

Bronze Memorial Tablet in memory of Wade Lawrence Crow, Class of 1901, by his family.

Bronze Memorial Tablet in memory of Raymond Bishop, Class of 1901, by his family.

Granite Memorial Tablet in memory of Professor Robert Nelson Hartman, by his colleagues, pupils, and friends.

The B. L. James M. and M. Co. Denver.
Calculating slide rule.

Rand Drill Co., New York.
Pictures of air compressors.

GIFTS TO THE LIBRARY.

	Books.	Pamphlets.
Agricultural College of Utah	..	1
Alabama Geological Survey	..	1
Alderson Pres. V. C.	50	13
American Book Co.	1	..
American School of Correspondence	13	5
American Swedenborg Publishing Co.	3	..
Amherst College	..	1
Armour Institute of Technology	..	1
Bailar, J. C.	..	1
Blake, W. P.	..	1
Bridge, J. H.	1	..
Chemical and Metallurgical Society of South Africa	1	2
Colgate University	..	1
Colorado Agricultural College	..	2
Colorado Normal School	..	1
Creighton University	..	1
Crosby Steam Gage & Valve Co.	1	..
Denver Public Library	..	2
Doane College	..	1
Doherty, H. L.	1	..
General Electric Co.	1	20
Ginn & Co.	4	..
Heath, D. C. & Co.	2	..
Holy Cross College	..	2
Ickis, H. M.	..	1
Indiana University	..	1
International School of Correspondence	11	..
John B. Stetson University	..	1
John Crerar Library	..	2
Johns Hopkins University	..	1
Lewis Foundry & Machine Co.	..	1
Lewis Institute	..	1
Louisiana State University	..	2
Macmillan Co.	4	..
Massachusetts Institute of Technology	..	2
Meyer, Dr. Paul	1	..
Mine & Smelter Supply Co.	1	..

Missouri School of Mines	..	1
Missouri University	..	1
Montrose County High School	..	1
New York State Museum	1	5
North Carolina University	..	1
Notre Dame University	..	2
Patton, Prof. H. B.	18	16
Purdue University	..	1
Rose Polytechnic Institute	..	1
Ross, David	1	..
Simpson College	..	1
Texas Christian University	..	1
Transcontinental Transportation & Mining Co.	1	..
Transvaal Technical Institute	..	2
Traphagen, Prof. F. W.	..	2
United States Government	325	185
University of Cincinnati	..	1
University of Colorado	..	7
University of Denver	..	1
University of Illinois	..	2
University of Michigan	..	1
University of Oregon	..	1
University of Utah	..	1
University of Vermont	..	1
University of Wisconsin	..	9
Ursimus College	..	3
Walker, Prof. L. C.	..	1
Washburn College	..	2
Washington University	..	1
Western Australia School of Mines	..	1
Whitman College	..	1
Wolcott, Prof. E. R.	..	1

PRIZES.

Mr. A. B. Frenzel, of Denver, has offered through the Colorado Scientific Society a prize of two hundred and fifty dollars to the student of the Colorado School of Mines who submits the best paper on "Tungsten in Colorado." The Colorado Scientific Society has appointed Mr. W. F. Edwards, Dr. W. P. Headden and Prof. Horace B. Patton as a committee to represent it in the matter.

Mr. A. B. Frenzel has also offered the college the following prizes:

I. Twenty-five dollars in books to be awarded to the best student in crystallography, blow-pipe analysis, and determinative mineralogy of the Sophomore year.

II. Twenty-five dollars in books to be awarded to the best student in general geology, lithology, and field geology of the Junior year.

III. Twenty-five dollars in books to be awarded to the best student in economic and field geology of the Senior year.

IV. Twenty-five dollars in books to be awarded for the best thesis of the Senior year.

A friend of the college has offered a cash prize of fifty dollars for the best thesis submitted by any member or members of the Senior class.

These prizes will be awarded at Commencement, May 26, 1905.

ASSAYING AND METALLURGICAL EXHIBIT AT THE LOUISIANA PURCHASE EXPOSITION.

The college has maintained during the period of the Exposition a working assay and metallurgical laboratory in the Metal Pavilion. It has been under the immediate supervision of the President and Professors Traphagen and Fleck, assisted by the students of the college, who have been sent to the exhibit in groups of four, each group spending three or four weeks in charge of the work. The exhibit was made possible by a Legislative appropriation of $3,000, supplemented by the liberality of the following firms in supplying the needed equipment: Denver Fire Clay Company, Denver, Colo.; Ainsworth and Sons, Denver, Colo.; Colorado Portland Cement Company, Denver, Colo.; American Gas Furnace Company, Elizabeth, N. J.; and the State Department of Mines of Colorado. It is believed that this is the first instance in the United States of a mining school making a practical working exhibit of the assaying and metallurgical processes as taught in school. The exhibit was awarded a gold medal.

SOCIAL CLUB.

Social life in the college is fostered by a regularly appointed body of students consisting of three members from each class. Several receptions during the year are given under their management.

Class of '05.

William E. Ryan, President.
Luther W. Lennox, Secretary and Treasurer,
Eldon L. Larison.

Class of '06.

William H. Freeland,
Rush T. Sill,
Martin Kleff.

Class of '07.

William W. Blackburn,
Franklin P. Lannon,
Philo D. Grommon.

Class of '08.

William C. Rambo,
Arthur G. Jaffa,
Charles T. Kennedy.

ENROLMENT OF STUDENTS
CLASS OF 1905.

SENIOR.

OFFICERS.

President, LUTHER W. LENNOX.
Vice-President, GEORGE B. PUTNAM.
Secretary, JULIUS HORNBEIN.
Treasurer, EVARISTO PAREDES, JR.

Allen, Carl A.	*La Junta, Colo.*
Austin, Arthur	*Denver, Colo.*
Bailey, Elbert W.	*Denver, Colo.*
Berry, Albert	*Leadville, Colo.*
Brown, Robert L. B. S., Beloit College.	*Denver, Colo.*
Busey, Alfred P., Jr.	*Pueblo, Colo.*
Carstarphen, Frederick C.	*Denver, Colo.*
Chamberlin, W. O.	*Denver, Colo.*
Cory, John J.	*Golden, Colo.*
Cuno, Albert F.	*Denver, Colo.*
D'Arcy, R. L.	*Denver, Colo.*
Duer, Charles L.	*Denver, Colo.*
Eames, L. B.	*Pueblo, Colo.*
Flint, Fred F.	*Greeley, Colo.*
Ford, Homer D.	*Denver, Colo.*
Garza, J. M. E. M., Stevens Institute of Technology.	*Torreon, Coahula, Mexico.*
Greve, Edgar E. E. M., Stevens Institute of Technology.	*Brooklyn, N. Y.*
Grider, R. L.	*Seiad Valley, Colo.*
Hallett, Robert L.	*Denver, Colo.*
Hallett, William J.	*Denver, Colo.*
Harrison, Thos. S.	*Evansville, Ind.*
Hewitt, Arthur F.	*Denver, Colo.*
Hornbein, Julius	*Denver, Colo.*
Hunt, T. R.	*Denver, Colo.*
Hyder, Charles A.	*Denver, Colo.*
Larison, Eldon L.	*Golden, Colo.*
Lee, Robert P.	*Denver, Colo.*

Lennox, Luther W	*Colorado Springs, Colo.*
Lewis, Alfred S	*Denver, Colo.*
Lonergan, Philip J	*Colorado Springs, Colo.*
McCart, Robert	*Denver, Colo.*
Middelkamp, Leroy L	*Pueblo, Colo.*
Muir, Douglas	*San Antonio, Texas.*
Neville, John B., Jr	*Denver, Colo.*
O'Byrne, Joseph F	*Cripple Creek, Colo.*
Paredes, Evaristo, Jr	*Culiacan, Sin, Mexico.*
Pfeiffer, G. N	*O'Fallon, Ill.*
Pressler, Louis P	*Golden, Colo.*
Putnam, George B	*Denver, Colo.*
Rabb, Edward M	*Denver, Colo.*
Rath, Charles M	*Telluride, Colo.*
Reinhard, Frank J	*Golden, Colo.*
Rice, George B	*Denver, Colo.*
Richards, Edwin R	*Montrose, Colo.*
Ryan, William E	*Denver, Colo.*
Smith, Eric M	*Montrose, Colo.*
Spangler, Howard	*Denver, Colo.*
Stoeckley, Ernest F	*Canon City, Colo.*
Terrill, Arthur C	*Colorado Springs, Colo.*
Thomson, Arthur T	*Pueblo, Colo.*

CLASS OF 1906.

JUNIOR.

OFFICERS.

President, RUSH T. SILL.
Vice-President, CHARLES N. BELL.
Secretary, WILLIAM H. FINIGAN.
Treasurer, WAYNE S. KELL.

Abel, Walter D.	*Denver, Colo.*
Aldrich, Harold W.	*Boulder, Colo.*
Allen, Maynard C.	*Denver, Colo.*
Armold, Clarence S.	*Golden, Colo.*
Badgley, Charles W.	*Denver, Colo.*
Ball, Max W.	*Golden, Colo.*
Barker, Franklin L.	*Golden, Colo.*
A. B., Colgate University.	
Bartholomew, Tracy	*Denver, Colo.*
Bell, Charles N.	*Denver, Colo.*
Braun, Arthur P.	*Toledo, Ohio.*
Brown, John B.	*Denver, Colo.*
Brown, Osborne E.	*Golden, Colo.*
Brunel, Rene L.	*Golden, Colo.*
Buell, Arthur W.	*Golden, Colo.*
Chapman, Thos. L.	*Aspen, Colo.*
Colburn, Clare L.	*Denver, Colo.*
Dow, William G.	*Denver, Colo.*
Ellis, Thomas P.	*Denver, Colo.*
Ellsworth, Alfred C.	*Chicago, Ill.*
B. S., University of Chicago.	
Emens, Ray	*Victor, Colo.*
Finigan, William H.	*St. Louis, Mo.*
Frank, M. E.	*Chicago, Ill.*
Freeland, William H., Jr.	*Denver, Colo.*
Friedhoff, William H.	*Pueblo, Colo.*
Gilbert, Arthur K.	*Denver, Colo.*
Gilbert, William J.	*Denver, Colo.*
Goodale, F. Augustus	*Trinidad, Colo.*
Gordon, John Gardner, Jr.	*Maplewood, Mo.*
Harkison, Charles W.	*Golden, Colo.*

Hazlehurst, Lindley M.	*Winnetka, Ill.*
Heitz, George H.	*Denver, Colo.*
Hensley, James H., Jr.	*Denver, Colo.*
Hollis, Don D.	*Golden, Colo.*
Ingersoll, J. Curtis	*Denver, Colo.*
Kell, Wayne S.	*Denver, Colo.*
Kleff, J. Marvin	*Golden, Colo.*
Koerner, Albert J.	*St. Louis, Mo.*
Levy, Archibald L.	*Denver, Colo.*
B. S. in C. E., Purdue University.	
Libby, Jas. L.	*Cheyenne, Wyo.*
McKee, M. D.	*Minersville, Pa.*
A. B., Yale University.	
Munroe, H. S.	*Joliet, Ill.*
Neugebauer, Karl E.	*Pueblo, Colo.*
Norton, Albert C.	*La Junta, Colo.*
Nyberg, H. E.	*Pueblo, Colo.*
Parks, George A.	*Denver, Colo.*
Patterson, Seely B., Jr.	*Allentown, Pa.*
Ripley, G. Clinton	*New York, N. Y.*
Schlereth, C. Quinby	*Denver, Colo.*
Sill, Rush T.	*Colorado Springs, Colo.*
Speer, Alexander	*Golden, Colo.*
C. E., Princeton University.	
Stephenson, Tiffany	*Ft. Morgan, Colo.*
Stotesbury, Harold W.	*Leadville, Colo.*
Thum, Ernest E.	*Denver, Colo.*
Van Wagenen, Hugh R.	*Denver, Colo.*
Waddey, Albert Y.	*Richmond, Va.*
Wegeforth, C. Parker	*Chicago, Ill.*
Whipple, Charles R.	*Brownsburg, Va.*
A. B., Washington and Lee University.	
Zulch, Herman C.	*Denver, Colo.*

CLASS OF 1907.

SOPHOMORE.

OFFICERS.

President, FRANKLIN P. LANNON, JR.
Vice-President, BENJAMIN W. PURDY.
Secretary, CHARLES E. NEWTON.
Treasurer, GEORGE P. MOORE.

Alsip, Albert A.	*Chicago, Ill.*
Armington, Howard C.	*Leadville, Colo.*
Bailey, W. G.	*Paterson, N. J.*
Barker, Pierce	*Philadelphia, Pa.*
Bastanchury, Gaston	*Fullerton, Cal.*
Benjovsky, Theo. D.	*Del Norte, Colo.*
Benton, Josiah H.	*Branford, Conn.*
A. B., Yale University.	
Blackburn, William W.	*Denver, Colo.*
Brandt, Arthur R.	*Denver, Colo.*
Broughton, Laurence L.	*St. Paul, Minn.*
Brown, Charles L.	*Golden, Colo.*
Brown, William E.	*Greeley, Colo.*
Brown, James B.	*Denver, Colo.*
Carpenter, Cranston H.	*Denver, Colo.*
Cater, George H.	*Golden, Colo.*
B. S., Northwestern University.	
Corson, Norman G.	*Del Norte, Colo.*
Curtis, Ben. K.	*Canon City, Colo.*
Ebersole, Dale G.	*Cincinnati, Ohio.*
Ehnbom, Lasse	*Boulder, Colo.*
French, Burr J.	*Denver, Colo.*
French, Sidney W.	*Denver, Colo.*
Geisel, Clarence R.	*Ouray, Colo.*
Golden, John P.	*O'Neill, Neb.*
B. S., University of Nebraska.	
Gow, Paul A.	*Golden, Colo.*
Grommon, Philo D.	*Denver, Colo.*
Head, F. L. R.	*Denver, Colo.*
Headech, William	*Nenaugh Co., Tipperary, Ireland*
Hemberger, Charles	*Golden, Colo.*

Howat, Andrew M.	*Salt Lake City, Utah*
Ireland, Carrol B.	*Golden, Colo.*
Isom, Edward W.	*Kenilworth, Ill.*
Iyengar, Krishnasami S.	*Bangalore, India*
Jacques, H. J.	*Denver, Colo.*
James, James S.	*La Crosse, Wis.*
Jacquette, Charles M.	*Grand Junction, Colo.*
Jess, John A.	*Springfield, Ill.*
C. E., Princeton University.	
Johnston, William M.	*Hygiene, Colo.*
Keene, Lewis M.	*Minneapolis, Minn.*
Kenner, Alvin R.	*Chicago, Ill.*
Kishman, Maurice W.	*Pueblo, Colo.*
Knight, Ruben E.	*Denver, Colo.*
Krueger, George S.	*Berthoud, Colo.*
Lannon, Franklin P., Jr.	*Pueblo, Colo.*
Lehman, Warren L.	*Chicago, Ill.*
Lehmer, Herman K.	*Omaha, Neb.*
Levell, Alexander	*Victor, Colo.*
Link, Karl G.	*Denver, Colo.*
Lyneman, Felix A.	*Denver, Colo.*
Maddux, Richard H.	*Golden, Colo.*
Martin, Jacob A.	*Golden, Colo.*
Merewether, Edward	*Hereford, England*
Merz, Julius H.	*Laramie, Wyo.*
A. B., University of Wyoming.	
Moore, Charles F.	*Denver, Colo.*
Moore, George P.	*Winsted, Conn.*
Newton, Charles E.	*Denver, Colo.*
Nova, Harry	*Brooklyn, N. Y.*
Overman, Benton	*Denver, Colo.*
Parsons, Fletcher H.	*Paterson, N. J.*
A. B., Wesleyan University.	
Patterson, Allan	*Walden, North Park, Colo.*
Phelps, William B.	*Los Angeles, Cal.*
B. S., St. Vincent College.	
Pray, Milton A.	*Golden, Colo.*
Prosser, Warren C.	*Silverton, Colo.*
Purdy, Benj. W.	*Durango, Colo.*
Quayle, Theodore W.	*Denver Mills, Colo.*
Reed, Thomas H.	*Kansas City, Mo.*
Reno, Charles A.	*Golden, Colo.*
Richards, A. F.	*Montrose, Colo.*
Ross, George M.	*Golden, Colo.*
Rudge, Harry	*Denver, Colo.*
Sandusky, Samuel C.	*Salida, Colo.*
Schilling, William B.	*Laramie, Wyo.*
Seltzer, Andrew J.	*Denver, Colo.*

Shaver, Francis J	*San Jacinto, Cal.*
Shields, Jas C	*Highland Park, Ill.*
Shumway, Ralph W	*University Park, Colo.*
Starnes, X. B.	*Asheville, N. C.*
Stuart, Malcolm M	*Denver, Colo.*
Taylor, Robert M	*Golden, Colo.*
Trott, Maynard J	*Golden, Colo.*
Wherry, Lindley P	*Denver, Colo.*
White, J. L	*Denver, Colo.*
White, Dudley A	*Colorado Springs, Colo.*
Whitehouse, H. D	*Golden, Colo.*
Wolf, Albert G.	*Golden, Colo.*
Wright, George T	*Paris, Texas*
Zeiger, Robert L	*Pueblo, Colo.*

CLASS OF 1908.

FRESHMAN.

OFFICERS.

President, WILLIAM C. RAMBO.
Vice-President, VAL DE CAMP.
Secretary, JOHN P. ADAMS.
Treasurer, ROBERT ELDER.

Adams, John P.	*Greeley, Colo.*
Anfenger, Max. B.	*Denver, Colo.*
Ashton, Millard H.	*Rutherford, N. J.*
Atkins, J. William	*Evanston, Ill.*
Baird, George K.	*Golden, Colo.*
Block, Gary E.	*Prescott, Arizona*
Bosquet, H. Fred	*Ouray, Colo.*
Bowman, Reginald G.	*Peru, Ind.*
Boyd, Jesse T.	*Silver Springs, Pa.*
Brinker, Albert W.	*Denver, Colo.*
Brown, Thomas G.	*Ophir, Colo.*
Brueggemann, Fritz	*Denver, Colo.*
Bryan, Russel R.	*Denver, Colo.*
Bunger, Milne E.	*Wheatridge, Colo.*
Burgess, Charles W.	*Denver, Colo.*
Burlew, George L.	*Denver, Colo.*
Butler, Reginald H. B.	*Leeds, England*
Chedsey, William R.	*Denver, Colo.*
Clapp, Harry B.	*Denver, Colo.*
Clarke, Melvin W.	*Denver, Colo.*
Crane, Francis J., Jr.	*Denver, Colo.*
Culbertson, John	*Bellevue, Pa.*
Curtis, Leroy P.	*Littleton, Colo.*
DeCamp, Val	*Denver, Colo.*
De Lescaille, Ray	*Davenport, Iowa*
Dilts, Ira J.	*Ft. Collins, Colo.*
Dunlevy, Forrest S.	*Denver, Colo.*
Elder, Robert B.	*Denver, Colo.*
Ellsworth, Huber H.	*Chicago. Ill.*
Emrich, Clarence T.	*Golden, Colo.*
Evans, Willis	*Golden, Colo.*

Fahey, William C	*San Antonio, Texas*
Feldman, Samuel A	*Denver, Colo.*
Flanders, Harvey H	*Glencoe, Ill.*
Fleischer, Ben.	*Denver, Colo.*
Fletcher, Thomas S	*Beatrice, Neb.*
Frick, Frederick F	*Peru, Ind.*
Goe, Harold H	*Colorado Springs, Colo.*
Grant, Dabney	*Kansas City, Mo.*
Greenewald, William E	*Denver, Colo.*
Halter, Richard G	*San Antonio, Texas*
Hemphill, Earl A	*Denver, Colo.*
Holderer, George B	*Denver, Colo.*
Hoyt, Maurice	*Golden, Colo.*
Hubbard, John V	*Colorado Springs, Colo.*
Hughes, Charles B	*Peru, Indiana*
Hughes, Grant	*Durango, Colo.*
Hull, Cecil B	*Denver, Colo.*
Jaffa, Arthur G	*Trinidad, Colo.*
Jensen, Anton	*Denver, Colo.*
Johnson, Walter	*Golden, Colo.*
Kemble, Jesse B	*Golden, Colo.*
Kennedy, Charles T	*Denver, Colo.*
Kilgore, William R	*La Junta, Colo.*
Knowles, Benjamin W	*Denver, Colo.*
Knox, Edgar C	*Independence, Mo.*
Koenig, George N	*Golden, Colo.*
Krowell, Andrew W	*Chicago, Ill.*
Lada, Paul F	*Golden, Colo.*
Lakes, Arthur, Jr	*Denver, Colo.*
Lesher, Carl E	*La Junta, Colo.*
Linderfelt, Robert J	*Golden, Colo.*
Linderfelt, Thomas C	*Golden, Colo.*
Meldrum, David T	*Oregon City, Ore.*
Morrison, Claude B	*Denver, Colo.*
Morrison, John	*Golden, Colo.*
Murch, Clarence H	*Denver, Colo.*
Nickerson, Chester	*Warsaw, Wis.*
Norris, Don R	*Denver, Colo.*
O'Byrne, Will H	*Cripple Creek, Colo.*
Olmstead, Fred J	*Golden, Colo.*
Page, Lawrence C	*Norfolk, Va.*
Pfeil, Walter H	*Pittsburg, Pa.*
Rambo, Wm. C	*Montclair, Colo.*
Roehrig, George F	*Denver, Colo.*
Rogers, Harry H	*Denver, Colo.*
Rood, Albert B. D. D. S. Northwestern University.	*Grand Junction, Colo.*
Root, Charles D	*Denver, Colo.*

Ross, Harry B.	*Denver, Colo.*
Russell, Carl L.	*La Porte, Ind.*
Sauter, Frank J.	*Golden, Colo.*
Shaffer, Byron L.	*Del Norte, Colo.*
Shellenberger, Henry N.	*Colorado Springs, Colo.*
Shonyo, Dwight E.	*Salida, Colo.*
Tennant, M. Roy	*Littleton, Colo.*
Thurston, Ralph V.	*Payette, Idaho*
Tuttle, Hiram H.	*Golden, Colo.*
Vaughn, Harold S.	*Denver, Colo.*
Vidler, S. Goring	*Georgetown, Colo.*
Watson, Scott	*Greenville, Miss.*
Weinig, Arthur J.	*Durango, Colo.*
Wheeler, Robert M.	*Denver, Colo.*
Wilson, Dudley M.	*Golden, Colo.*
Wilson, Raymond C.	*Pueblo, Colo.*
Wolfe, George T.	*Cripple Creek, Colo.*
Wood, Ernest B.	*Denver, Colo.*

ENROLMENT BY CLASSES.

Senior Class	50
Junior Class	58
Sophomore Class	86
Freshman Class	96
Total	290

GEOGRAPHICAL DISTRIBUTION.

Colorado	214
Illinois	16
Pennsylvania	6
Missouri	6
Indiana	5
Texas	4
New Jersey	3
Nebraska	3
Virginia	3
New York	3
California	3
Wyoming	3
Wisconsin	2
Connecticut	2
Minnesota	2
Ohio	2
Iowa	1
Oregon	1
Idaho	1

Mississippi	1
Arizona	1
Utah	1
North Carolina	1
England	2
Mexico	2
India	1
Ireland	1
Total	290

THE ALUMNI BY CLASSES.

Those marked with an asterisk are deceased.

1883.

Middleton, William B.................................*Denver, Colo.*
Mining Engineer.
Wiley, Walter H...............................*Idaho Springs, Colo.*
Mining Engineer.

1886.

van Diest, Edmund C...............................*San Luis, Colo.*
Superintendent Maxwell Land Grant.
Gehrmann, Charles A..........................*Idaho Springs, Colo.*
Superintendent Consolidated Stanley Mining Co.

1888.

Ambrosius, Carl E........................*Guanacevi, Durango, Mex.*
Mining Engineer.
*Floyd, John A............................
*Kingman, Jerry ....
*Lorah, Bela I.............................

1889.

Bellam, Henry L.................................*Anaconda, Mont.*
Chemist, Anaconda Mining Co.
Craigue, William H..........................*Colorado Springs, Colo.*
Mining Engineer.
*Wertheim-Salomonson, F. M. G. A...........

1890.

Comstock, Charles W..................*213 Boston Bldg., Denver, Colo*
Civil and Mining Engineer

1891.

Johnson, Edward W.................................*Murray, Utah*
Assistant Superintendent Murray Plant, Am. S. & Ref. Co.
Smith, Charles D.............................*Atacama, Peru, S. A.*
Metallurgist.

1892.

Aller, Frank B. ... *Peru, S. A.*
Metallurgist with M. Guggenheim.
Brown, Norton H. ... *Denver, Colo.*
Surveyor General's Office.
Budrow, William B. ... *Pueblo, Colo.*
Assistant Superintendent, Philadelphia Smelter.
Cole, Burt ... *St. Louis, Mo.*
Chief Engineer Illinois Fuel Co.
Hindry, Willis E. ... *El Oro, Estado de Mexico, Mexico*
General Manager Esperanza Mining Co.
Kimball, George K., Jr. ... *Idaho Springs, Colo.*
Superintendent, Old Town Consolidated Mining Co.
Kimball, Joseph S. ... *Denver, Colo.*
Surveyor General's Office.
Lewis, William B. ... *Denver, Colo.*
President, Pine River Lumber Co.
McMahon, Charles H. ... *Santa Barbara, Chihuahua, Mexico*
General Superintendent, Montezuma Lead Co.

1893.

Collins, Philip M. ... *Salida, Colo.*
Mining Engineer, S. and R. Reduction Works.
Hawley, R. Howard ... *Monterey, Mexico*
Chemist, National Mexican Smelting Co.
Jewell, Gilbert E. ... *Chartres Towers, Queensland, Australia*
Metallurgist.
Milliken, William B. ... *Denver, Colo.*
Mining Engineer.
Osborne, Arthur H. ... *Georgetown, Colo.*
U. S. Deputy Mine Surveyor.
Stephens, Wallace A. ... *1361 Logan Ave., Denver, Colo.*
Mining Engineer.

1894.

Atkins, Horace H. ... *Pueblo, Colo.*
Chemist and Assayer, Philadelphia Plant.
Bowie, James W. ... *Gallup, New Mex.*
Mine Superintendent, Caledonia Coal Co.
Post, George M. ... *2928 Hale St., Denver, Colo.*
Assistant City Engineer.
Saint Dizier, Julius L. ... *San Luis Potosi, Mexico*
Assistant Superintendent Cia Metalurgica, Mex., N. A. Smelter; Consular Agent of France; Professor of Analytical Chemistry and Metallurgy at the Scientific Institute.
Schneider, George W. ... *135 Logan Ave., Denver, Colo.*
State Mine Inspector.
Wheeler, Charles E. ... *Lampazos, Mexico*
Mining Engineer.

1895.

Arthur, Ed. P. ... *Cripple Creek, Colo.*
Mining Engineer and U. S. Deputy Mine Surveyor.
Davis, Carl R. ... *Rossland, B. C.*
Superintendent, War Eagle and Central Star M. Co.

Dockery, Love Atkins.............................*Chihuahua, Mexico*
Ashton & Dockery, Mining Engineers.
Durell, Charles T....................*Gilt Edge, Fergus County, Mont.*
Manager Central Montana Mines Co.
Eaton, Albert L.................................*Chihuahua, Mexico*
Mining Engineer, Chihuahua and El Potosi Mining Co.
Eye, Clyde M......................................*Rossland, B. C.*
Superintendent, Rossland Power Co.
Field, Fred M...*Pony, Mont.*
Metallurgist.
Gray, Latimer D...............................*Rock Springs, Wyo.*
Electrical Engineer, Union Pacific Coal Co.
Hartzell, Lester J....................................*Butte, Mont.*
Instructor in Laboratories, Montana School of Mines.
Kennedy, George A..................*2709 Boulevard F., Denver, Colo.*
Mining Engineer.
Limbach, Edmund C..............................*Gilt Edge, Mont.*
Superintendent, Chicago-Montana Gold Mining Co.
Maxwell, Fred A. G..............*Randfontein, Transvaal, South Africa*
Metallurgist, Randfontein Estates.
Merryman, Herbert E...........................*Cripple Creek, Colo.*
Surveyor.
Parker, James H...................................*New York, N. Y.*
Student, Columbia University.
Rowe, Edmund E..................*325 Irvington Place, Denver, Colo.*
Manufacturer, E. E. Rowe & Co., Pressed Brick.
*Shetler, Waverly ....
Skinner, Lewis B.....................................*Denver, Colo.*
Western Chemical Manufacturing Co.
Stannard, Burt C...................................*Everett, Wash.*
Chemist, Puget Sound Reduction Co.
Stockton, Robert S.................................*Billings, Mont.*
Engineer, Crow Reservation Project, U. S. Geological Survey.
Suhr, Otto B...............................*Niagara Falls, Ontario*
Resident Engineer, The Niagara Construction Co.
Titsworth, Frederick S................*202 Boston Bldg., Denver, Colo.*
Lawyer.
Wallace, Lewis R...................................*Morenci, Ariz.*
Superintendent, Detroit Copper Co.
Young, Frank B..................*Box 81, Exeter, Tulare County, Cal.*

1896.

Atkinson, Walter J...................................*Chicago, Ill.*
Civil Engineer.
Barensheer, William J............*Taylor and Bert Sts., Denver, Colo.*
Assayer.
Barnes, Corrin......................*1843 Lawrence St., Denver, Colo.*
Assayer and Chemist.
Beeler, Henry C...................................*Cheyenne, Wyo.*
Wyoming State Geologist.
Dwelle, Jesse E..........................*Piute, Kern County, Cal.*
Bright Star Mine.
Griswold, George G.....................*1260 Race St., Denver, Colo.*
Chemist, Globe Smelter.
Hoyt, George F............................*Mapimi, Durango, Mexico*
Assistant Superintendent, Smelter Minera de Peñoles.
Maynard, Rea E.........................*Honolulu, Hawaiian Islands*
Milliken, John T...............................*Deadwood, S. Dak.*
Imperial G. M. & M. Co.

Mitchell, George B....................*67 Dubord St., Montreal, Canada*
Assistant Engineer, Canadian Pacific Railway.
Nance, William H.............................*Breckenridge, Colo.*
Superintendent Milling Department Quandary Mountain Mining and Milling Co.
Newnam, William E....................................*Omaha, Neb.*
Chemist, A. S. & R. Co., Omaha Plant.
Paul, William H.......................*2136 Marion St., Denver, Colo.*
Mining Engineer.
Strout, Fred McL.................................*Deadwood, S. Dak.*
General Superintendent, Golden Crest Mining Co.

1897.

Buck, Arthur H..........................*Miniaca, Chihuahua, Mexico*
Engineer, Sunset Mining Co.
Bussey, Edwin E...............*136 Florissant St., Cripple Creek, Colo.*
Gold Coin Mine, Victor.
Canning, Herbert A.....................................*Aspen, Colo.*
Mining Engineer.
Cohen, Louis..........................*Sombrerete, Zacatecas, Mexico*
Assayer, Sombrerete Mining Co.
Draper, Marshall D...............*210-220 McPhee Bldg., Denver, Colo.*
Mining Engineer, American Exploitation Co.
Febles, John C...............................*Box 153, Butte, Mont.*
Chemist, Anaconda Copper Mining Co.
Gross, John ....*Maitland, S. Dak.*
Mill Superintendent, Maitland Properties.
Hazard, W. J..*Golden, Colo.*
Assistant Professor of Electrical Engineering, Colo. School of Mines.
Jarvis, R. P......................................*Pullman, Wash.*
Professor of Mining and Metallurgy, Washington Agricult'al College.
Kelley, W. A..*Denver, Colo.*
Chemist, McArthur-Forest Co.
Lerchen, F. H......................*630 Bryson Block, Los Angeles, Cal.*
Stephenson-Bennett Const. M. Co., Organ, N. M.
Logue, N. W...................*El Tigre, Sonora, Mexico (via Douglas)*
Mining Engineer.
MacGregor, George H...........................*Central City, Colo.*
Old Town Mine.
McLeod, J. Norman....................................*Salida, Colo.*
Assayer and Chemist.
Nelson, H. E.........................*711 Fifth Ave., Spokane, Wash.*
Engineer for Bradley Eng. & Mach. Co.
Nye, Robert............................*1821 Sixth Ave., Moline, Ill.*
Manager of the Moline Mining Co.
Powell, George F.................*Venus Camp, Cal. (via Yuma, Ariz.)*
Superintendent, California King Gold Mines Co.
Roller, Arthur H..................................*Idaho Springs, Colo.*
Superintendent, Shafter Mining Co. and Hudson Reduction Co.
Schumann, Enrique A.......................
Starbird, H. B......................................*Victorville, Cal.*
Lessee and Manager, Rose Mine.
Warnecke, Carl M.....................................*Sherman, Cal.*
Chief Electrician, Los Angeles-Pac. Railway Co.
Weed, Floyd ....*Kimberly, Utah*
Care Annie Laurie Mine.
Woods, Thomas H......................................*Ouray, Colo.*
Superintendent, Camp Bird (Limited) Mills.

1898.

Barbour, Percy P. .... *Idaho Springs, Colo.*
Surveyor, Stephens & Barbour.
Bertschy, Perry H. .... *Gilt Edge, Mont.*
Chemist, Great Northern M. & D. Co.
Blumenthal, Emil E. .... *Philipsburg, Mont.*
Chemist, Granite Bi-Metallic Mining Co. Con.
Caldwell, Florence H. (Mrs. Frank H. Jones) .... *Trail, B. C., Canada*
Church, Myron J. .... *Victor, Colo.*
Clark, Winfred N. .... *Victor, Colo.*
Superintendent, Mountain Division Pueblo and Suburban Traction and Lighting Co.
Corry, Arthur V. .... *Butte, Mont.*
Manager, Mont d' Or Mine.
Davey, William R. .... *Lake City, Colo.*
Assayer.
Dollison, James E. .... *Alma, Colo.*
Surveyor and Proprietor Alma Assay Office.
Hamilton, Frank R. .... *Ouray, Colo.*
Assayer, Camp Bird Mine.
Harrington, Orville .... *Rock Springs, Wyo.*
Mining Engineer.
Ingols, J. August .... *Idaho Springs, Colo.*
Mining Engineer and U. S. Deputy Mineral Surveyor.
Johnston, Fred .... *Torreon, Coahuila, Mexico*
Assistant Superintendent, Campania Metallurgica.
Jones, Frank H. .... *Trail, B. C., Canada*
Chemist, Rossland Power Co.
Kraemer, Edw. L. .... *Morenci, Ariz.*
Detroit Copper Co.
Lampe, Oscar A. .... *Parral, Mexico*
Assayer.
Lucy, Richard W. .... *Idaho Springs, Colo.*
Surveyor.
Magenau, William .... *Trail, B. C.*
Mining Engineer.
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Mining Engineer.
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Smith, Harry C. .... *1132 Washington Ave., Denver, Colo.*
Mining Engineer.
Stephens, Charles N. .... *2605 Douglas Place, Denver, Colo.*
Draftsman, Colorado Telephone Co.
Valentine, Malvern R. .... *Box 108, Victor, Colo.*
Manager, Taylor & Brunton Sampler.
Whitaker, Orvil R. .... *San Juancito, Honduras, C. A.*
Superintendent, New York, Honduras and Rosario Mining Co.

1899.

Adami, Charles J. .... *Box 612, Butte, Mont.*
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Bruce, Stuart S. .... *502 Boston Bldg., Denver, Colo.*
Mining Engineer.
Cramer, Curtis P. .... *Tierro, New Mexico*
Assayer, Gilchrist & Dawson Co.
Davis, Gilbert L. .... *816 Majestic Bldg., Denver, Colo.*
Assistant Engineer, Denver City Tramway Co., Denver, Colo.

Grant, Lester S. . . . . *214 W. Eaton Ave., Cripple Creek, Colo.*
Superintendent, Isabella Gold Mining Co.

Hodgson, Arthur . . . . *Denver, Colo.*
Assayer, Denver Mint.

Johnson, Gilbert . . . . *Kennett, Shasta County, Cal.*
Engineer, Trinity Copper Co.

Kelley, Fred G. . . . . *Milford, Utah*
Superintendent and Metallurgist, Majestic C. M. & S. Co.

Muir, David . . . . *Kennett, Shasta County, Cal.*
Engineer, Trinity Copper Co.

Rising, Arthur F. . . . . *Modoc Prov., Ontario, Canada*

Royer, Frank W. . . . . *4003 W. Thirty-fifth Ave., Denver, Colo.*
Mining Engineer.

Smith, Thomas G. . . . . *1415 Thirty-fifth St., Denver, Colo.*
Assistant Supt., Grant-Plant American Sm. & Ref. Co.

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Superintendent, Rocky Mountain Coal & Iron Co.

Townsend, Arthur R. . . . . *117 E. Fifty-seventh St., New York City*
Mining Engineer, Liberty Bell G. M. Co.

Tyler, Sydney B. . . . . *Ocampo, Durango, Mexico*
Superintendent, San Luis Mining Co.

Waltman, Will D. . . . . *108 N. Wahsatch Ave., Colorado Springs, Colo.*
Assistant City Engineer.

Weiss, Andrew . . . . *Chamber of Commerce Bldg., Denver, Colo.*
U. S. Geological Survey.

Williams, Wakely A. . . . . *Grand Forks, British Columbia*
Superintendent, Granby Cons. M. & Sml. Co.

1900.

Adams, Wilber E. . . . . *36 Adams Block, Lewiston, Idaho*
Mining Engineer and U. S. Deputy Mineral Surveyor.

Benwell, George A. . . . . *211 California Bldg., Denver, Colo.*
Mining Engineer.

Bruce, Harry F. . . . . *Tonopah, Nevada*
Electro Geodetic Mg. Co.

Crowe, Thomas B. . . . . *Cripple Creek, Colo.*
Assistant Manager, Gold Exploration Co.

Drescher, Frank M. . . . . *Prescott, Ariz.*
Mining Engineer.

Evans, Henry R. . . . . *Reno, Nevada*
U. S. Government Survey.

Ewing, Charles R. . . . . *Del Norte, Colo.*

Giddings, Donald S. . . . . *Narotari, Sonora, Mexico*
Chief Surveyor and Engineer, Pilares Mines.

Harrington, Daniel . . . . *Sunnyside, Utah*
Assistant Engineer Utah Fuel Co.

Jones, Edward B. . . . . *Dooley Block, Salt Lake, Utah*
General Manager, St. Julien Gold M. & M. Co.

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Engineer, Stratton Consolidated Mines.

Lemke, Carl . . . . *Silverton, Colo.*
Grand Mogul Mine.

Malmstrom, Clarence C. . . . . *Box 57, Idaho Springs, Colo.*
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Moynahan, Ambrose E. . . . . *Alma, Colo.*
Assayer and Mining Engineer.

Nicolson, George W. . . . . *Box 34, Mojave, Cal.*
Superintendent, Queen Esther Mine.

Pendery, John M. .... *Leavenworth, Kan.*
Platt, Edwin H. .... *Denver, Colo.*
Assistant Manager, Denver Engineering Works.
Price, Lyttleton, Jr. .... *Bellevue, Idaho*
Minnie Moore Mining Co.
Prout, Jno. .... *Golden, Colo.*
Robey, Lloyd .... *Gabriel, Durango, Mexico*
San Luis Mining Co.
Rudd, Arthur H. .... *Golden, Colo.*
U. S. Deputy Mineral Surveyor.
Slater, Amos .... *408 Boston Bldg., Denver, Colo.*
Geological Department C. F. & I. Co.
*Smith, Claude H. ....
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Taylor, Henry Picotte .... *Box 785, Salt Lake City, Utah*
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Engineer, North Jellico Coal Co., Taylor Coal Co. and Williams Coal Co.

1901.

Atwater, Maxwell W. .... *Box 573, Telluride, Colo.*
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*Bishop, Raymond ....
Bowman, Frank C. .... *Central City, Colo.*
Cyclops Assay Office.
Bradley, Joseph M. .... *Box 778, Florence, Colo.*
Breed, Charles Francis .... *817 Boston Bldg., Denver, Colo.*
Colorado Fuel & Iron Co.
Brinker, Arthur C. .... *517-18 Cooper Bldg., Denver, Colo.*
With J. B. Farish, Mining Engineer.
Bruce, James L. .... *Flat River, Mo.*
Surveyor, Federal Lead Co.
Bumsted, Edward J. .... *Howardsville, Colo.*
Mining Engineer, Highland Mary Mine, Gold Tunnel, Drainage & Transportation Co.
Burlingame, Walter E. .... *1736 Lawrence St., Denver, Colo.*
Chemist and Assayer, E. E. Burlingame & Co.
Chandler, John Winthrop, Jr. .... *Coulterville, Mariposa County, Cal.*
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Assayer, Eilers Plant, American Smelting & Refining Co.
Collins, Shrive B. .... *Box 94, Amethyst P. O., Creede, Colo.*
Mining Engineer.
*Crow, Wade L. ....
DeCou, Ralph E. .... *Table Mountain, Mammoth P. O., Ariz.*
Table Mountain Copper Co.
Downer, Roger H. .... *Ironton, Colo.*
Superintendent, Barstow Mill.
Ehle, Mark, Jr. .... *Rapid City, S. Dak.*
Professor of Engineering in the South Dakota School of Mines.
Frank, Harry L. .... *Dedrick, Trinity County, Cal.*
Engineer, Trinity Co. Gold Mining Co.
Harris, Willard F. .... *Ouray, Colo.*
Chief Engineer, Camp Bird Mine.
Jackson, Walter H. .... *St. Louis, Mo.*
Illinois Exhibit Department of Mines and Metallurgy, Louisiana Purchase Exposition.

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Surveyor, Denver & Northwestern Railway.

Lewis, Frank E..........................*1224 Stout St., Denver, Colo.*
Surveyor, Colorado Telephone Co.

Lovering, Ira G....................................*Somerset, Colo.*
Utah Fuel Co.

Lucy, Frank Allen.............................*Idaho Springs, Colo.*
Surveyor.

McDaniel, Alexander K..............*731 W. Granite St., Butte, Mont.*
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Marrs, George Oliver............... ....*Central City, Colo.*
Surveyor, Saratoga Mine.

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Velardina Mining & Smelting Co.

Millard, Frank W.......................................*Ely, Nevada*

Parrish, Carl C......................................*Tuolumne, Cal.*
Superintendent, New Era Mining Co.

Pray, Winfred A......................................*Golden, Colo.*
Surveyor and Mining Engineer.

Sale, Andrew J..*Ely, Nevada*

Scheble, Max C....................*South McAlester, Indian Territory*
Surveyor, Great Western Coal & Coke Co.

Simpson, William P...............................*Monterey, Mexico*
Head Assayer, Monterey Plant, American Sm. & Ref. Co.

Small, Harvey B............................*Ojuela, Durango, Mexico*
Engineer, Compania Minera de Peñoles.

Starbird, Edwin P.................................*Victor, California*
Lessee, Rose Mine and Mill.

Street, Gerald B..............*56 W. Fourth South St., Salt Lake, Utah*
The Samuel Newhouse Co.

Watson, Hugh C.........................*San Juancito, Honduras, C. A.*
Mill Superintendent, New York & Honduras Rosario Mining Co.

Williams, Fred Tuttle.....................................*Victor, Colo.*
Mining Engineer, Portland Gold Mining Co.

1902.

Anderson, Neil A.......................................*Frisco, Utah*
Surveyor, Cactus Co.

Badger, Herbert E......................................*Greeley, Colo.*
Mining Engineer, Badger and Badger.

Barron, Chauncey T...............................*El Paso, Texas*

Bergh, John Evans.............................*Bingham Canon, Utah*
Mining Engineer, Bingham Con. M. & S. Co.

Bucher, John William..........................*Arispe, Sonora, Mexico*
General Manager, Robiscanora Gold Mining Co.

Butler, G. Montague....................................*Golden, Colo.*
Instructor in Geology and Mineralogy, Colorado School of Mines.

Charles, Lavern J...................................*Spokane, Wash.*
U. S. Geological Survey.

Christensen, Walter ....*Mercur, Utah*
Metallurgist, Mercur Gold Mining Co.

Collbran, Arthur Harry..................*Kuala Lijus, Pahang, Korea*
Ketchan Syndicate.

Cox, W. Ray...*Wallace, Idaho*
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Ehrich, Walter L..................*320 Sansome St., San Francisco, Cal.*
Mining Engineer.

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Mining Engineer.
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Surveyor, Mining Bureau.
Lehmer, Frank Welton..................................*Gebo, Mont.*
Engineer, Gebo Coal Co.
Montrose, James Fay..................................*Lead, S. Dak.*
Assayer, Hidden Fortune Mine.
Moss, Cleveland Osgood...........................*Red Rock, Ariz.*
Engineer, Imperial Copper Co.
Paul, Russell B.........................*San Juancito, Honduras, C. A.*
Mining Engineer, New York, Honduras & Rosario Mining Co.
Powers, Oliver ....*Telluride, Colo.*
Telluride Power Transmission Co.
Reno, Horace Thornton................................*Fraser, Colo.*
Surveyor, Denver & Northwestern Railroad Co.
Richards, John V.....................................*Kendall, Mont.*
Kendall Mine.
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Storm, Lynn W.....................................*Clear Creek, Utah*
Pleasant Valley Coal Co.
Watts, Alfred C......................*817 Boston Bldg., Denver, Colo.*
Engineer, Rocky Mountain Coal & Iron Co.

1903.

Coghill, W. H.......................................*Calumet, Mich.*
Assistant Engineer, Tamarack Mining Co.
Coleman, R. Prewitt.........................
Cox, Augustus D.....................................*Mullan, Idaho*
Devinney, George V...................................*Creede, Colo.*
Chemist, East Willow Mining Co.
Dunkle, Fred W.......................................*Victor, Colo.*
Elkton Consolidated M. & M. Co.
Emrich, Horace H..................*142 Water St., Perth Amboy, N. J.*
American Smelting & Refining Co.
Fleming, William L..............................*Box 75, Victor, Colo.*
Timberman.
Foster, George C.....................*1734 Arapahoe St., Denver, Colo.*
Henry E. Wood & Co.
Fry, Louis D........*San Jose de Cruces, via Parral, Chihuahua, Mexico*
Assayer and Surveyor.
Funk, Walter A.................................*Central City, Colo.*
Mining Engineer and U. S. Deputy Mineral Surveyor.
Hyder, Frederick B..............*Mountain City, Elko County, Nevada*
U. S. Deputy Mineral Surveyor, Nevada and Colorado.
Izett, Glenn ....*Littleton, Colo.*
Denver Union Water Company.
King, Henry E.............*419 East Kiowa St., Colorado Springs, Colo.*
Transitman, City Engineer's Office.
Liddell, Charles A.............................*Box 353, Denver, Colo.*
Mining Engineer.
Liddell, T. Parker..............................*Box 353, Denver, Colo.*
Mining Engineer.
McDermutt, Grace C. U.................*760 Newton St., Denver, Colo.*
McElvenny, Robert F.................*514 North G St., Tacoma, Wash.*
Metallurgist, Tacoma Smelter.

Merwin, Eugene W........................
Nagel, Frank J........................*San Juancito, Honduras, C. A.*
Assayer, New York & Honduras Rosario Mining Co.
Palsgrove, Harry G.....................*San Juancito, Honduras, C. A.*
Asst. Supt. and Engineer, N. Y. & Honduras Rosario Mining Co.
Parsons, H. F.............................
Rhodes, William B....................................*Ouray, Colo.*
Mining Engineer.
Sloan, W. Arthur...........................*Silver City, New Mexico*
Superintendent, Chatham Copper Co.
Taggart, George K.......................*Coapa, Michoacan, Mexico*
Mining Engineer and Supt. National Capital Copper Mining Co.
Ward, William F....................................*Ruby, Mont.*
Assistant Engineer, Conrey Placer Mining Co.
Wattles, William C.......................*Macleod, Alberta, Canada*
Assistant Engineer and Surveyor for Dominion of Canada.
Wells, Frank B....................................*Telluride, Colo.*
Liberty Bell Mine.
Wolf, Harry J.............................*Box D, Telluride, Colo.*
Mining Engineer, Ella Gold Mining Co.

1904.

Adams, Charles.........*1507 Washington Ave., Colorado Springs, Colo.*
General Metals Co.
Anderson, Axel E.............................*Tallopoosa, Georgia*
Georgia Gold Mines Co.
Carney, Hugh J......................................*Ouray, Colo.*
Mining Engineer.
DeSollar, Tenny C................................*Cooney, N. M.*
Mogallon G. & C. Co.
Emeis, Walter A....................................*Victor, Colo.*
Ajax Gold Mining Co.
Fillins, Lee L..................................*Georgetown, Colo.*
Franck, Albert C....................................*Ouray, Colo.*
Assayer, Barstow M. & M. Co.
Franck, Robert P.........................*623 Main St., Butte, Mont.*
Gagnon Mine.
Goodale, Stephen L.........................*Colorado Springs, Colo.*
Camp Bird (Limited), Ouray, Colorado.
Hill, Frank C...*Ouray, Colo.*
Ouray Smelting Co.
Johnson, L. G......................*2218 Lafayette St., Denver, Colo.*
Kilbourn, W. D.................*199 South Main St., Middletown, Conn.*
Manufacturer.
Kimball, Harlow M............................*Great Falls, Mont.*
Boston & Montana Cons. Copper & Silver Mining Co.
Larsh, Walter S..................*2109 Sixteenth Ave., Denver, Colo.*
Lee, Wallace.....................*601 Mumford Ct., Kansas City, Mo.*
Nagel, Henry P.............................*Independence, Colo.*
Vindicator Gold Mining Co.
Prier, Truman D...................................*Ruby, Mont.*
Courey Placer Co.
Robinson, George P..........................*Howardsville, Colo.*
Highland Mary Mine,, Gold Tunnel, Drainige & Transportation Co.
Sherman, Scott H.................................*Holmes, Wyo.*
Duchess M. M. & S. Co.
Spencer, W. Irving..............................*Park City, Utah*
Daly West Mill.

Tescher, Samuel.......................... *Canon City, Colo.*
Assistant to Division Engineer of C. F. & I. Co.

Thomas, John S.................................... *St. Louis, Mo.*
C. S. M. Exhibit, Louisiana Purchase Exposition.

Thomson, Francis A............................ *Forks Creek, Colo.*
Superintendent, Bates Mill.

Trumbull, L. W.................................... *Laramie, Wyo.*
Professor of Mining Engineering, University of Wyoming.

*Vaughn, Robert M.........................

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Wallace, Howard J.................................. *Durango, Colo.*
Surveyor.

Washburn, H. G.. *Vietor, Colo.*
Portland Gold Mining Co.

Weil, Jacob.............................. *4543 Ellis St., Chicago, Ill.*

Wells, B. T.................................. *Grand Forks, B. C.*
Chemist, Cranby Cons. Mining, Smelting & Power Co., Ltd.

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Montana	17	New York	2
California	16	Nebraska	1
Utah	12	Kansas	1
Arizona	6	Kentucky	1
Washington	5	Texas	1
South Dakota	5	Indian Territory	1
Wyoming	5	Michigan	1
Nevada	5	New Jersey	1
Missouri	4	Georgia	1
Idaho	4	Connecticut	1
New Mexico	3		

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Mexico	24	Hawaiian Islands	1
Canada	6	Philippine Islands	1
British Columbia	6	South Africa	1
Honduras	5	Australia	1
South America	2	Korea	1

ALUMNI ASSOCIATION.

The Association of the Alumni of the Colorado School of Mines holds its annual meeting and banquet on the day following the commencement exercises, unless otherwise provided by the Executive Committee.

All graduates holding degrees are eligible to membership, and are invited to the annual meeting and banquet.

The aim of the Association is to promote acquaintance and friendship among the graduates, to encourage them to aid each other, and to make an organized effort to elevate and uphold the reputation and standard of their Alma Mater.

All graduates are earnestly requested to join the organized body and to keep the Secretary advised as to their addresses.

The officers of the Association for the year ending June, 1904, are as follows:

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Herbert A. Canning, '97, Vice President.
Amos Slater, '00, Secretary.
Gilbert L. Davis, '99, Treasurer.

Executive Committee.

Edward E. Rowe, '95.
Edward P. Arthur, '95.
Marshall D. Draper, '97.

Address all communications for the Alumni Association, P. O. Box No. 236, Denver, Colorado.

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